RAILROAD GAZETTE

FRIDAY, JUNE 17.

NEWS OF THE WEEK.

We give below, in a condensed form, the leading news items of the week. These items will be found in detail in their appropriate columns.

Meetings Next Week.—Cincinnati, Hamilton & Dayton; Fort Worth & Denver City; Illinois Central; Oregon Railway & Navigation Co.; St. Paul & Duluth.

Elections.—Arizona Mineral Belt, J. W. Eddy, President.—Cortez & Dolores, Burtis L. Arbecom, President.—Cumberland & Piedmont, Thomas B. Davis, President.—Fort Worth & Rio Grande, B. B. Paddock, President.—Minnesota & Northwestern, George C. McMichael, Superintendent of Des Moines Division.—Northern Pacific, C. P. Cole, Superintendent of Cascade Division.—Southern Pacific, W. G. Van Vleck, Superintendent of Louisiana Division.

New Companies Organized.—Atlanta, Knoxville & Northwestern files charter in Tennessee.—Clay City, Minneapolis, Kanapolis & Western is incorporated in Kansas.—Cortez & Dolores is incorporated in Colorado.—Dallas, Archer & Pacific files charter in Texas.—East Portland-Vancouver Railway & Ferry Co. is incorporated in Oregon.—Garden City, Dighton & Southern is incorporated in Kansas.—Hope & Shreveport files articles in Arkansas.—Leroy & Carey Valley Air Line files charter in Kansas.—Marietta & Lake Erie files articles in Ohio.—Minessota & Southwestern is incorporated in Minessota.—Newton, Attica & El Paso is incorporated in Kansas.—Newport & New York Rapid Transit obtains charter in Rhode Island.—Pennsylvania & New England Construction Co. is incorporated in New Jersey.—Rich Hill, Arkansas City & El Paso is incorporated in Kansas, Missouri and Texas.

Changes and Extensions.—*Indiana:* Cincinnati, Hamilton & Dayton begins survey from Richmond to Jonesborough.—*Kansas:* Denver, Memphis & Atlantic is completed from Chetopa to Stafford.—*Louisiana:* A road is to be built from Prudhomme Station to Natchitoches.—*Massachusetts:* Old Colony begins work between Matfield and Easton. *Missouri:* St. Louis, Oak Hill & Carondelet is completed from St. Louis to Carondelet.—*New Jersey:* New Jersey Junction is completed from Weehawken to Jersey City.—*Texas:* Gulf, Colorado & Santa Fe begins grading from Cleburne to Weatherford; Dunison, Bonham & New Orleans begins work.—*Virginia:* Suffolk & Carolina is extended 6¼ miles.

Leases and Sales.—Cincinnati, Hamilton & Dayton sells its controlling interest in the Dayton & Michigan.—Chicago, Kansas & Nebraska is leased by the St. Joseph & Iowa.

Traffic.—Anthracite coal shipments for the week ending June 11 show a decrease of 5.1 per cent., as compared with corresponding week last year; bituminous shipments show increase of 18.9 per cent.; coke, for week ending June 4, shows decrease of 80.5 per cent.; cotton receipts, interior markets, for the week ending June 11, show a decrease of 44.2 per cent., as compared with the corresponding period last year; shipments show a decrease of 73.9 per cent.; seaport receipts show decrease of 82.2 per cent.; exports, a decrease of 93.1 per cent.; cotton in sight is less than at same date last year by 32.5 per cent.

Earnings.—One hundred and two roads report gross earnings for May, 92 showing an increase for the month, and 10 a decrease.

Miscellaneous.—Buffalo, Rochester and Pittsburgh directors vote to increase capital stock $1,000,000.—Kansas City, Wyandotte & Northwestern contracts for entrance into Kansas City.

Contributions.

The Carpenter Brake.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your last week's issue appears an article over the signature of "A Practical Man," attacking my brake in a manner that clearly shows how little he practically knows of the construction of the brake he so authoritatively tries to condemn. Truthful and thorough criticism, no matter how severe, no one could object to; but glaring misstatements and unjust presentation of facts about a new brake are hardly fair either to the parties concerned or to the railroad public. From the statements made, I question if "A Practical Man" was present at the trials, or ever saw my brake in action. The manner in which he counts up the number of parts in my brake is particularly amusing, and reminds one of a similar attempt made in Europe some years ago to discredit the Westinghouse system, then on trial against a vacuum brake. A "practical man" over there counted up and compared the great number of parts in the Westinghouse air pump as against the plain ejector used by the vacuum people, and the complicated triple valve as against the plain diaphragm, and argued quite authoritatively there from that "the Westinghouse brake could never be of any practical use." Yet, every railroad man knows which system of these two really gives the best results and the least failures. So it may prove with electric brakes, despite the many hundred parts (no more than in the Westinghouse brake) so industriously counted up by our "practical" friend on a 50-car train.

As to the incident he refers to, of displaced connections, he is incorrect in stating that it happened immediately after a satisfactory stop had been made, for it was the first stop of the day. The facts are, the train had finished the regular tests, and had lain on a siding some days, during which time some wires on the engine had purposely been disconnected; a special test was called for, and the train started out of the siding early one morning, when it was found at the first stop that one connection had not been properly made. This was on the engine. It was made, and the trip proceeded without other mishap. None of the "many hundred springs and other multitudinous parts," referred to by our "practical" friend, were examined, for a really practical man knew just where to look for the defect, and, of course, found it at once. Much capital has been made out of this incident by those opposed to electricity, but one may as reasonably ask if it would be different with the Westinghouse air brake if a train started out without previous inspection, and the stop-cock on the back of the tender happened to remain closed. Could the engineer stop the train as usual at the first halting place? Such mistakes may happen to the best-devised brake systems, but it is only very unpractical men who try to make capital out of them. As to the daily and nightly policing of the train "by able and watchful electrical experts," I greatly fear that our friend had the vigil all to himself (if he was in Burlington at all), for no one connected with the brake was there to keep him company.

In conclusion, I may refer to the fact that the Westinghouse Company came to the trials openly avowing disbelief in electricity, and referring to their electric features as the "hippodrome attachment;" yet they were compelled to use this same hippodrome attachment in order to get out of the trials with any semblance of skin.

Their well-known air brake was practically withdrawn from the regular tests after making only three stops, and without even finishing the first run with their 50-car train. Subsequent extra experiments show that even with the improved triple severe shocks were experienced in a moving train of only 25 cars. It, therefore, ill-becomes the Westinghouse Company to pronounce the use of electricity unpractical. If it is so why did they use it in the regular tests so largely? Most of their regular runs were made by its help. Why do they not recommend the use of electricity? Is it because they do not control the patents, or is it on account of some other unknown but equally philanthropic reason?

J. FAIRFIELD CARPENTER.

Practical vs. Educated Railroading.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The objections of "Practical Man" to the application of electrical appliances to freight train brakes, illustrating as it does the self-satisfaction of much conservative ignorance on our railroads, may justify you in giving space to some further remarks on the subject.

There seems no contention as to the desirability of securing the effects exhibited by the application of electricity referred to. The plain railroad man objects to the necessity for able and watchful electrical experts, and triumphantly asks as a "clincher," "What would a practical man anticipate as the result of confiding such a multitude of delicate contrivances to an ordinary train crew?"

Now it seems pertinent to ask, right here, what sort of a practical man does your correspondent call himself, to propose sending out such a multitude of delicate contrivances in the care of an *ordinary* train crew?

It seems to the writer that this is a question as to whether the ordinary train crew should be retained or a better educated and more intelligent class of men should be secured. There are certain expenses and inconveniences combined with an uncertain element of danger connected with the present administration of freight train brakes. With electrical brakes there will be other expenses, inconveniences and dangers, and this is the case with all improvements, in addition to which there is a possibility of improvements in the electrical contrivances.

These considerations should and will be balanced, surely with a due regard to the feelings of an ordinary train crew and practical men generally, and if it is found as the result that the advantages are with delicate contrivances combined with educated men at a decidedly higher price, *they will make the thing work even after several changes of engines*, and they will be queerly educated Americans if they do not eliminate many of its delicate contrivances and increase the certainty of its operation.

E. M. F.

The Washington Meeting of the American Society of Mechanical Engineers.

May 31 to June 3, 1887.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Congress had adjourned, the President had gone fishing, and Washington wanted relaxation, therefore we were welcomed in an interesting speech by Mr. Webb, the President of the Commissioners of the District of Columbia. This gentleman congratulated us on our mechanical achievements, and thought that by our efforts the steam engine had become a household appliance—is it possible he had dined at a restaurant where the hash was dissected by a steam chopper? He held out the hope that the future had great things in store for us, and as he spoke many thought sadly of their diminished bank accounts, of the opening of the summer season, when every member of the family *except* the wage earner would flock to the restful sea shore, or to the invigorating mountains, and we trusted Mr. Webb was correct in his conclusions, but this hope, faint as it was to the veterans, was immediately dispelled by the closing sentence, "And your best reward" (here one could have heard a pin drop) "is the benediction of every good man."

To this address our President, Mr. Geo. H. Babcock, responded in a fitting manner.

The session having fairly been inaugurated, the report of the Committee on Uniform Tests was made by Mr. Henry R. Tame, to the effect that while much had been accomplished yet the matter was not in shape to present, since the various replies to the circular sent out to the manufacturers had not been classified.

The supplementary report of the Committee on Standard Threads and Standard Pipe was made by Mr. Geo. M. Bond. It was to the effect that their former report recommending the Briggs standard covered all but special pipe, and they hardly thought worth while to recommend any standard for this, as it was not in universal use.

An invitation to visit the Manual Training School at Baltimore was read, and also a letter from John W. Weston, Commissioner General for the U. S. at the Paris Railway Jubilee. Mr. Weston hoped all American manufacturers would unite in making this exhibit worthy of our country, and would either be present themselves or send a suitable delegate, which last has been done by the Yale & Towne Company already in the person of Mr. G. C. Hening.

Following this came the first paper of the session, "Tests of Comparative Value of Different Kinds of Belting," by Saml. Webber. The result of Mr. Webber's experiments, which were given at length and illustrated by diagrams and tables, showed that the leather-lined canvass belt, invented by Mr. J. H. Underwood, member of the society, gave the best results. Mr. Webber further stated that the belts were tried without oiling. He also found that wooden or paper pulleys had a superior holding capacity. There was some discussion on this paper. The next paper read was "Should a Piston Packing Ring be of the Same Thickness at Every Point," L. H. Rutherford. This was a purely theoretical document, since it reached no conclusions, but left the question open for discussion. It might be wise to follow the author's plan, and if any reader of the *Railroad Gazette* wishes to discuss it, he can draw from the document arguments for whichever side he chooses, for figures *properly* handled are susceptible of being used for almost anything.

"The Systematic Testing of Turbines in the United States," by Prof. R. H. Thurston, was the next paper, and in it the author showed how much had been done in this line, beginning back with 1823, and bringing the history to the experiments of Mr. James B. Francis, at Lowell, and those of Clemens Henchell at Holyoke; the flume at the latter place had already become a standard, and he believes that sooner or later all large manufacturers would have their own testing flume.

Professor Thurston also presented a paper on "Helical Seams in Boiler Making," which was on the whole unfavorable to such practice.

That afternoon, the Society visited the Corcoran Gallery, and admired the beauty of the paintings and statuary, as well as the noble liberality of the founder, and the writer feels quite sure that he voices the wish of hundreds of thousands in the hope that this gentleman may speedily recover from his present severe illness.

The evening session commenced with "The Education of Intuition in Machine Designing," by John T. Hawkins. This gentlemen believed there was a middle ground between pure theory and pure practice, and the paper was a search for this neutral zone, so to speak. Should this land ever be found all dreams of Atopia will be realized and the science of mechanical engineering will be baptized by the new Desotos in that fountain of youth which their projenitor died in the effort to discover.

Charles E. Emery's two papers, "On Cylinder Condensation," and on the "Limit of Pressure in Marine Engines," were then read and not very much discussed, but his third paper, "Comparative Value of Steam and Hot Water for Transmitting Heat and Power," was discussed with some vigor. Mr. Emery believed in steam, but there were not wanting those who believed in hot water and they made it hot water for him.

Albert Stearns described "Evaporation by Exhaust Steam," in which he showed a novel form of evaporation pan.

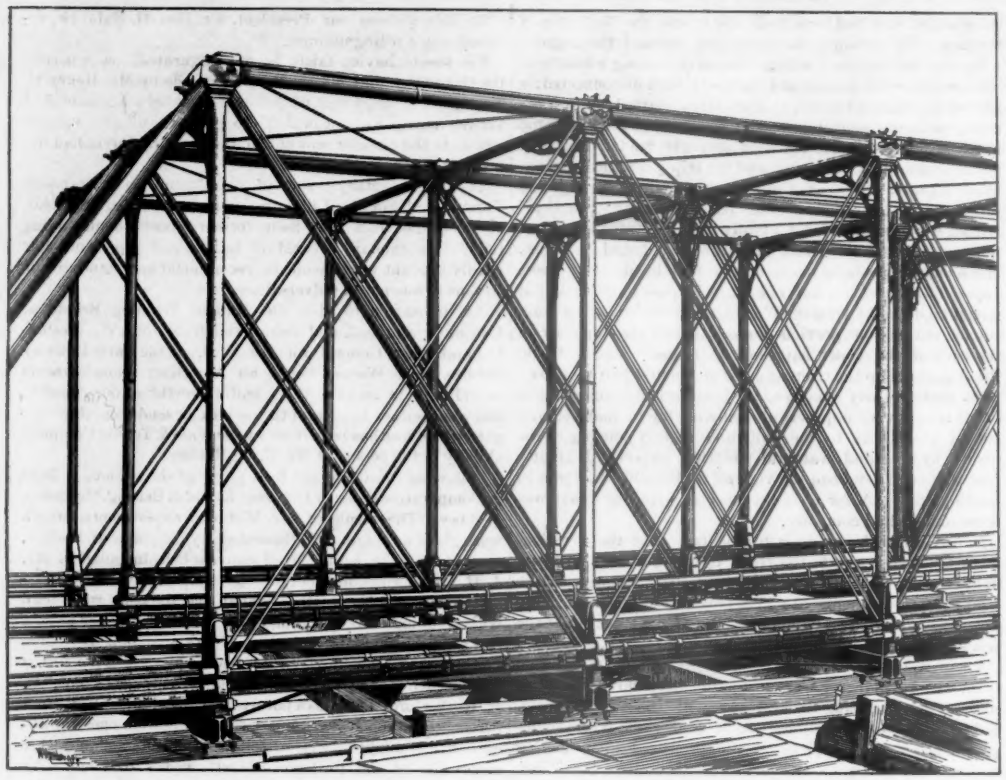
The next morning was devoted to the various objects of interest around the city, and the afternoon to economical treatises, such as "Methods of Determining Cost and Distribution of Heat and Power," by Mr. H. R. Towne, and "A Problem in Profit Sharing," by Mr. Wm. Kent, the former being drawn from Mr. Towne's practice and the latter from Mr. Kent's theory. A delightful reception at the Hon. Josiah Dent's formed a fitting ending to this day, and all "retired in good order."

On Thursday all went to Mount Vernon, saw the tomb of Washington, his camp-chest, private flask, etc. Some were actually taken on the fly by the enterprising but cheeky photographer. The party then crossed to Marshall's plantation and ate planked shad.

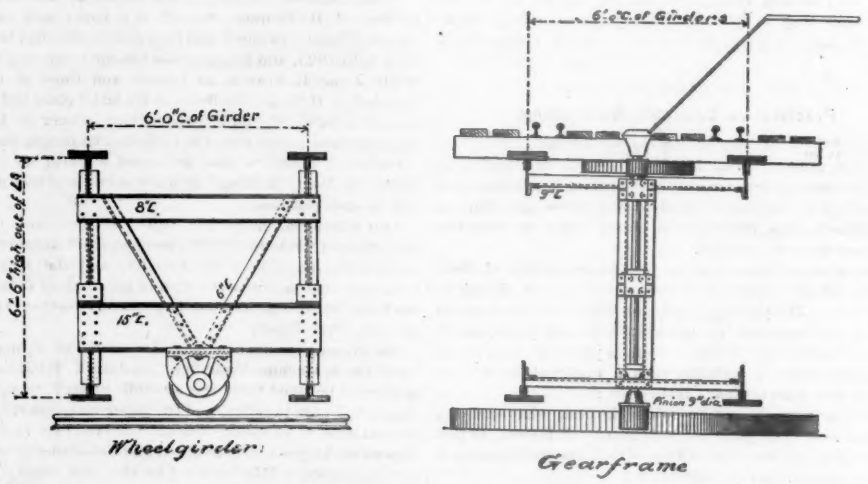
Having been on the water most of the day, the engineers were fitted to consider the "Needs of Our Navy," by Mr. H. A. Ramsay, and the navy seemed to need about everything a navy could. It wanted especially guns and ships; there was no mention of any need of additional officers, probably because there was a class about to graduate at Annapolis.

The "National Defense Problem," by Mr. Jas. Morgan, Jr., closed this evening. The speaker advocated the immediate protection of 27 harbors by substantial forts and heavy guns, he showed how it could be done and the probable cost. The only discouraging feature was the statement it would take 10 years to complete this, but, as is stated in the "Mikado," "If one only made the effort that would be *something*," and will our bickering, wire-pulling Congress listen to the voice of our people, or must it be thundered into their ears, too late, by foreign iron-clads?

Cabin John bridge, the largest stone arch in the world,



OLD DRAWBRIDGE, NEWARK BAY, CENTRAL RAILROAD OF NEW JERSEY.



TEMPORARY DRAWBRIDGE, NEWARK BAY.

occupied the party on the following morning. This structure is about 6 miles from Washington, and is a span of 220 ft., rising from the springing line 57½ ft.

The session was concluded by the following papers: "Direct Acting Veneer Cutters," by Thomas S. Crane, where the knife is directly attached to the piston; "Making Tubes from Solid Bars," by Mr. George H. Babcock, which is one of the things you can see but not understand, as was predicted in the Bible would be the fate of the old laws; and "Gas Lighting by Incandescence," by Mr. James Dredge, editor of *Engineering*, of London, and honorary member of the society. The last paper should have been illustrated by special apparatus showing the various methods employed, and the author had been at great pains to so arrange the matter. Unfortunately this apparatus was on the "Celtic," and as she and the "Britannic" both tried to sail on the same line, the apparatus never arrived in time, hence the paper was not so interesting as it was intended to be.

It only remained to thank our kind hosts and to trust they would speedily return our visit. X.

The Newark Bay Drawbridge.

A short time since the drawbridge at Newark Bay on the line of the Central Railroad of New Jersey was replaced by a more substantial structure and one more in accordance with modern methods of bridge building. The work is of interest because it removes a bridge which may be said to represent the practice of a quarter of a century ago, and because of the novel manner of accommodating the traffic on both the road and water while the old bridge was being removed and the new one erected.

The old draw possessed several peculiar features, and although the design, judging from our present standpoint, would be considered extremely faulty, it would border on the ridiculous to severely criticise it when, for twenty-five years, the bridge had carried safely every legitimate load to which it had been subjected, and then been retired honorably on account of old age. About twelve years ago a train entered the bridge before it had been locked, and after traveling on the ties over the first span the locomotive went through the floor of the other.

The accompanying engraving conveys a clear idea of the old bridge. It was 214½ ft. long, 19½ ft. high, and the width between the trusses was 18 ft. The tension members were composed of round wrought-iron bars, and the compression members were cast-iron tubes. Each bottom chord consisted of four bars, those at the centre of the bridge being 2½ in. in diameter, and those at the ends 1½, the size of the intermediate bars being graduated between the two. The length of the bars equaled the length of the panels, 12 ft. 9⅝ in. centre to centre, and their adjoining ends were threaded to enter collars formed in cast-iron blocks supporting the posts. This construction permitted of adjusting the height of either end of the bridge and was found to be exceedingly convenient. After many years of use each of the bottom chords was stiffened by two tubes (shown in the centre truss in the drawing) strapped to it, this reinforcement being made necessary owing to the danger of buckling when the ends of the bridge were unsupported while swinging. Each post rested upon a block through which the diagonals passed, and upon which were formed inclined seats to receive the nuts holding the diagonals. Vertically through the blocks extended holes to receive bolts, the heads of which were countersunk, and which carried the floor beams, two I beams being under each post. The posts rested directly upon the tops of the blocks, completely covering the bolts, and thereby rendering impossible either an inspection or renewal. As a consequence, the first intimation of the weak condition of a bolt would be given by its breaking and falling into the water. This defect was remedied by cutting away the upper side edges of the blocks to form seats over which were passed straps or hangers to support the floor beams. This addition did away with all uncertainty, and made easy the close examination of a most vital part of the bridge. Upon the floor beams were placed stringers and ties in the usual manner. All the vertical posts tapered from the centre toward each end; those at the middle of the bridge were 11¼ in. in diameter in the centre, and those at the ends were 6 in. The inclined end posts were cylindrical, 12 in. in diameter, and were built in two sections. The top chords were 9 in. in diameter at the centre of the bridge and 8 in. at the ends. Each of the top chords was reinforced by two bars which served as tension members during the opening and closing of the draw. The top chords were united by transverse cast-iron tubes, and diagonals, and at the intersection of the tubes and posts were placed cast-iron brackets.

This bridge was designed to meet the requirements of twenty-five years ago, and yet it has, with the few additions we have mentioned, been enabled to carry the heavy engines of to-day. This speaks well for the materials entering into its construction.

For many reasons, which are apparent, it was not considered advisable to remove the old bridge by means of floats and then float in the new one. It was decided to build a side track, for the accommodation of travel, extending out into the bay sufficiently far to clear the draw, and to provide this side track with a small temporary draw. Piles were therefore driven and a side track erected having a total length of 1,108 feet between points of tangents on the old trestle, and being at its furthest point 127 ft. from the old trestle; at the draw it was 112 feet from the trestle. The side track had two sets of rails, placed 8 in. apart, no switches being used at their connection with the main tracks. The western opening of the draw was closed by the track and the eastern opening was provided with a small draw-span, the principal details of which we herewith illustrate.

The small draw had a total length of 97¾ ft. over all and was so pivoted that one arm was 30¼ ft. long and the other 67½ ft. The weight of the long arm was counterbalanced by pig iron arranged at the end of the short arm. The pivot was located at the northern end of the eastern abutment of the main draw, and the long arm swung toward the main track and rested in a recess in the abutment when the bridge was in an open position. The bridge turned upon four wheels, 20 in. in diameter, spaced equal distances apart, and rolling upon a track circle 8 ft. in diameter. The bridge was operated by means of a crank on a vertical shaft carrying a pinion 6 in. in diameter, 4½ in. face, engaging with a gear 36 in. in diameter, mounted on a second vertical shaft at the bottom of which was a pinion 9 in. in diameter meshing with a rack placed outside the track circle. When closed, the outer end of the long arm rested upon wheels upon which the end bearing rolled. The opposite end bearing rested upon a bed plate. The bridge was locked by rods attached one at each side of the fulcrum of a lever at the pivot, so that the movement of the lever in one direction withdrew the bolts while a reverse movement forced them out.

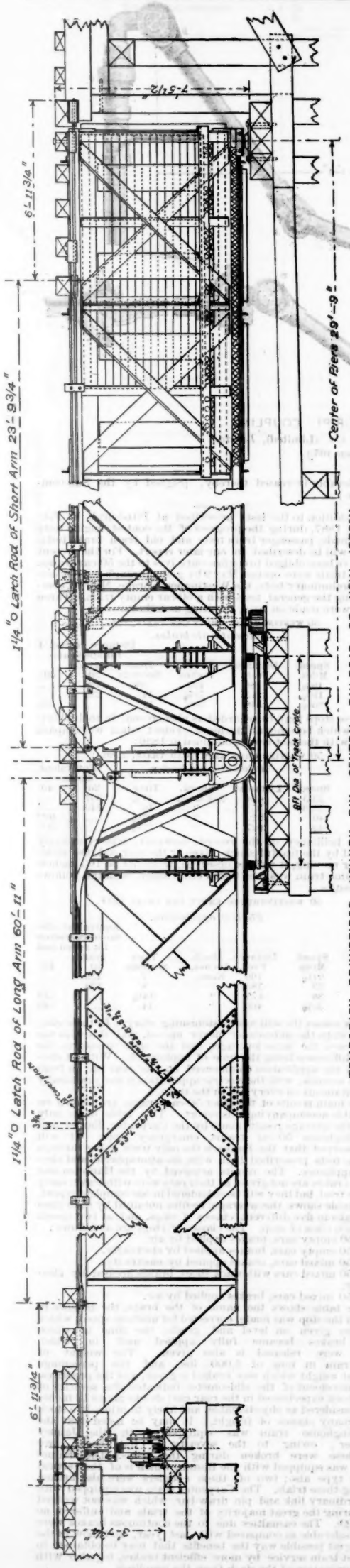
The main draw, designed and erected by the Phœnix Bridge Co., is 217 ft. in length and 28 ft. from centre to centre of trusses. The centre panel is 22 ft. centre to centre of posts and 32 ft. in height. Each span consists of five panels, 19½ ft. centre to centre, and is so designed as to form a bridge, having inclined end posts independent of the centre panel, which serves to support the two spans when the bridge is swinging. The top chord is inclined, the height of the bridge at its outer ends being 21 ft. The top and bottom chords and the inclined end posts are each composed of two plates, angled and latticed together. The three outer vertical posts upon each span are of the same description, but in place of the fourth post are two eye bars. Eye bars unite the top chords of the spans with the top chords of the centre panel.

The bridge turns upon cone wheels 16 in. in diameter, the upper track being horizontal and the lower one inclined. The diameter of the lower track is 28⅛ ft. The bridge is turned by steam, the operating machinery being located in engine house in the top of the centre of the structure. The time necessary to unlock the draw and raise the rails is one-half a minute, and to open the draw 90 degrees three-quarters of a minute, making the total time required for operating the draw one minute and a quarter. The draw is also provided with hand gearing by which it can be opened in four minutes.

Annual Meeting of the Master Car-Builders' Association.

The convention was opened in Curtis Hall, Minneapolis, June 14, at 10 a. m. There was a very full attendance of members. After the Rev. Mr. Tuttle had offered prayer, Mayor Ames delivered a short address welcoming the association. After referring to the energy and growth in civilization of Minneapolis, he stated that he was a surgeon, and a railroad surgeon at that, and that much of his practice was derived from injuries received in coupling cars. It was considered in the Northwest that the Eastern cars were especially dangerous. He hoped the convention would be able to improve the present coupling apparatus, and render it less dangerous to life and limb. The President of the association responded, thanking the Mayor for his cordial welcome.

The PRESIDENT then delivered his annual address, in which he alluded to the generally recognized benefits derived from these and similar meetings. Among the important works achieved during the past year were the freight train brake trials at Burlington, in July, 1886, and May, 1887. The coupler question was perplexing. He could not agree that directors and officers were careless as to the injuries and loss of life caused in coupling cars, and thought that something might be gained by greater care on the part of the men themselves. It had been found by actual observation that they would not use sticks except when the officers were around. He believed no body of men were more willing to try experiments with any proposed improvement than railroad officers. The heating and lighting of passenger cars is also a question of safety and cannot be ignored. There was some difference of opinion as to the construction of some of



the rules of interchange, and he hoped that it would be satisfactorily settled at this meeting. He alluded in feeling terms to the death of Leander Garey, for so many years president of the association, and suggested that a resolution expressing sympathy with his family be passed. The Secretary's report stated that there were 231 members in 1886 against 223 in 1885. Since then there had been some change, and the present membership was 238. The accounts showed $300 deficit of receipts below expenses, the printing of the discussion on rules of interchange having caused some considerable extra expense. The President recommended that three minor executive officers be made a committee to regulate the admission of new members. This duty now practically devolves upon the Secretary.

Mr. J. W. CLOUD moved that United States and state railroad commissioners be invited to participate in the discussions of this and future conventions. Carried.

The SECRETARY then read some correspondence with Mr. W. W. SNOW as to the adoption of the standard Christie brake shoe so that they will interchange. At present several slightly different patterns of Christie shoes are in use. The shoe shown in the standard drawing of the Master Car-Builders' Association is that used by the Boston & Albany. The majority of roads use a shorter Christie shoe. The Baltimore & Ohio, Michigan Central and New York Central are now using the shoe as shown in the engraving.

Mr. F. D. ADAMS, Mr. J. W. CLOUD and others urged that the standard remain unchanged, which was the general feeling of the meeting.

It was resolved that the Secretary be ex officio a member of all committees for investigation and experiment.

Mr. F. D. ADAMS moved that a vote of condolence be given to the family of the late Leander Garey. Carried.

Messrs. ADAMS and LAUDER wished that railroad commissioners should participate in discussions, but objected to their becoming members as suggested. Motion lost.

The reports of committees on Appliances for Safety of Trainmen and on British and Continental Practice were not presented.

Mr. RHODES then read the report of the Committeee on Freight Train Brakes.

REPORT OF COMMITTEE ON FREIGHT TRAIN BRAKES.

Your committee on freight train brakes completed a second series of tests on the first of this month which extended over a period of three weeks this year and four weeks in 1886. It has not been possible to have a full report of such extended work ready for this meeting. A statement of the tests with tables, engravings, and diagrams is however being compiled, and will be completed in time to be embodied in the Association's published annual report. We must ask your indulgence, therefore, if we briefly give you an account of the gradual growth of the tests and allude to some of the leading features they have brought out.

In submitting a report to the convention in 1885 the committee apologized to the Association for drawing attention to so important a question on the meager investigation they at that time had been able to make, and called attention to the fact that a complete report should be based upon an elaborate series of competitive tests. None of your committee recognized at that time that these tests which were so indispensable to the investigation of the subject were also within easy reach and merely required action on their own part. This fact has an evident bearing on all investigations, and we have, therefore, alluded to it prominently. The framing of the different tests prescribed at the joint meetings which were afterwards inaugurated with the representatives of the brake companies and the criticisms which have grown up from publishing the proceedings of these meetings have been equally instructive. An old member of your Association wrote regarding the competitive tests proposed for Dec. 14, 1885, that "while not indorsing the conditions imposed, he was glad to see them published. They would provoke criticism; that out of criticism grew discussion and from discussion we reaped progress." The fact that your committee will now be able to present results gathered from a carefully conducted series of tests is largely due to their having availed themselves of the discussions they have awakened and the assistance that has been given from outside sources.

At the convention of June, 1885, the Chairman was authorized to add three members to the original committee. From the discussion which followed the presentation of their first report it appeared desirable that the additional members should have had experience with or be disposed to advocate independent brakes which at that time were looked upon favorably by many, consequently Messrs. John S. Lentz, Master Car-Builder Lehigh Valley Railroad; W. T. Hildrup, President Harrisburg Car Manufacturing Company, and D. H. Neale, Editor *Railroad Gazette*, were added to the committee.

Your committee met at Buffalo, in September, 1885, and decided that a public contest was indispensable in any further investigations. The following month, through the courtesy of the Chicago, Burlington & Quincy Railroad Co., your committee was enabled to propose a series of brake tests, the conditions of which were announced by circular Oct. 15, 1885. This proposed trial produced considerable criticism both from brake companies and members of the Association. These tests were subsequeutly abandoned; the correspondence they had provoked, however, enabled your committee to organize a series of joint meetings with the different brake companies, which resulted in a brake trial commencing July 13, 1886, at Burlington, Iowa.

These tests lasted until Aug. 2. There were five competitors present, the Eames automatic vacuum, the Westinghouse automatic air-brake, the American buffer brake, the Rote buffer brake and the Widdifield & Button brake. The results of these early tests have been fully published; none of the competing brakes in the estimation of your committee did satisfactory work with 50-car trains, and therefore the proposed endurance tests, and the April 1887 tests were abandoned, and a new series of 1887 tests for 50 car trains only prepared, giving both old and new companies the opportunity of remedying the faults in their brakes when applied to long trains, so forcibly brought out during the 1886 tests.

The most important of these faults was the unlooked-for effect of slack in long trains, controlled with power brakes, when applied in succession from the engine, and the prominent part that the shock in the rear cars at once assumed with all the train brakes that were brought to our notice. The expected difficulties in applying and releasing continuous brakes on trains of 50 cars were shown to be no more serious than would occur with an ordinary passenger train, and the complete failure of the independent brakes was convincingly brought out.

At the May, 1887, tests five companies were represented, the Westinghouse air brake, the Eames vacuum, the Hanscom air brake, the Carpenter electro-atmospheric brake, the Card electric brake. It will be observed that only the continuous type of brake entered the contest this year. The 1886 tests had shown clearly that quick application on long trains was the only method of avoiding the shock at the rear of the train. Special attention had been given this by the competitors; even the Westinghouse and Eames companies coming in 1887 with electric appliances adapted to their brakes, through which they could obtain instantaneous application. It is a well recognized fact that there is no mechanical difficulty in getting any amount of braking power on a car; the difficulty has been in getting a quick application.

The Westinghouse Co. used 50 Pennsylvania Railroad standard 60,000 lb. cars, the average weight being 30,577 lbs., and fitted with the Janney coupler. The brakes were fitted this year with a new quick action triple valve. The first sharp reduction of air puts the triple valve nearest the engine into action, and the air it draws from the train-pipe starts the next triple, and so on throughout the entire train. The electric device used is explained in our sub-committee's report; it consisted of a valve which by the passage of an electric current let the air in the train-pipe escape into the atmosphere. It is not intended to use this valve on every car, but in some three or four points on a long train. Its practical effect was, instead of allowing the air to escape from the train-pipe only at the engineer's valve, it escaped at four points on the train.

The Eames Vacuum Brake Co. had 50 cars built to the Chicago, Burlington & Quincy standard for the brake company in Chicago. They have also made important changes during the past year which have greatly increased the brake's efficiency. The diaphragms and auxiliary reservoirs have been enlarged. The main improvements, however, are in the ejector, the valve, its electric attachment and the leverage. The leverage is arranged with a floating fulcrum, the effect of which is to increase the power with the travel of the diaphragm. The brake shoes being hung from the car body, their distance from the wheels and consequently the stroke of the diaphragm is increased when the car is loaded, and the effect of the floating fulcrum is to increase the leverage when the car is loaded.

The Hanscom brake consists of an air pump for compressing air; an engineer's brake valve for the distribution of air; two lines of train pipes and a brake cylinder under each car, on which is an automatic valve for setting the brake automatically in case the train breaks in two. The brake-cylinders are made longer than the stroke of the piston, so that sufficient air remains in one end to apply the brakes in case of a train breaking in two.

The Carpenter electro atmospheric brake was fitted to an Illinois Central engine and 50-car train, each car of 40,000 lbs. capacity, and averaging 27,351 lbs. light weight. It consists of an air pump, main reservoir, etc., on the engine and a brake cylinder and auxiliary reservoir underneath each car. The train-pipe is always in direct communication with the auxiliary reservoirs. The brake can be applied by letting the air out of the train pipe, but it cannot be released by sending air into the train pipe. The brake can also be applied or graduated by an electric current, which operates an electric valve on each cylinder. Another electric valve is used to release the brake.

The Card is purely an electric brake, applied to 50 Cincinnati, Hamilton & Dayton cars of 50,000 lbs. capacity, and averaging 26,000 lbs. light-weight. It is fully described in the sub-committee's report. The passage of an electrical current causes two drums under each car to grip one another. One drum was constantly revolving, being driven by a chain from the axle, and the brake chain was attached to the other drum, consequently when the latter drum was made to revolve it wound up the brake chain and applied the brake. This brake required some special arrangement on the last car of the train, an obvious objection during the introduction of the brake on any road, and in this respect differed from the other brakes.

The following is the report of a sub-committee composed of Mr. A. H. Bowman, Electrician, Lehigh Valley; Mr. E. M. Herr, Acting Supt. Telegraph, Chicago, Burlington & Quincy; Mr. O. E. Stewart, formerly Supt. Telegraph Chicago, Burlington & Quincy, now Superintendent of the East Iowa Division of the Chicago, Burlington & Quincy:

Report of Sub-Committee on Electric Features of Brakes.

BURLINGTON, Iowa, May 25, 1887.

Mr. Godfrey W. Rhodes, Chairman M. C. B. Brake Committee:

DEAR SIR: In pursuance with the committee's instructions in letter of May 19, we have made an investigation of the electrical appliances used by the Eames, Carpenter, Westinghouse and Card brake companies in the 1887 brake test, and respectfully submit the following report:

As to the use made of electricity we find the brakes represented naturally divide themselves into two classes, one in which electricity is entirely depended upon for the proper operation of the braking mechanism, the other in which it is used as an auxiliary or addition to a braking device complete in itself.

In the first class are found the Carpenter electro air brake and the Card electric brake.

In the second the Westinghouse automatic air brake and the Eames automatic brake.

All the above are arranged on the open circuit system, with the exception of the Card, in which the circuit is closed, but the two batteries, one on the engine and one on the car, are so opposed to each other that in the normal condition no current passes through the train. In the open circuit system it is to be understood that unless the brakes are either being applied or released, no current is passing or being supplied by the batteries or other electro generating devices. This is also practically true in the closed circuit system employed by the Card Brake Company.

Taking up in order the four brakes examined we have first the Carpenter Electro Air Brake. The electrical appliances used by this brake company consist of a secondary "Julien" battery of eight cells carried in a box upon the left-hand side of the engine, securely fastened to the frame and guide yoke, and two systems of electro-magnets connected in multiple arc upon the three wire system, one set of magnets operating the admission, the other the release valves. They also exhibited a magneto machine, by means of which the brakes could be operated by the engineer independently of the battery. This machine was not properly adjusted for the work to be done on these tests and was, therefore, not used. The brake and release valves referred to above are shown in section on Drawing No. 892 of the Carpenter catalogue, in which a full description of the brake mechanism is given. [A diagram is inserted here and an explanation of the electrical connections.—ED.]

The connections between the wires on different cars are made automatically in coupling the brake hose by means of contact pieces in the hose coupling, as shown on drawing No. 901 of the Carpenter catalogue. These pieces are held in firm contact by a powerful spring, and are well rubbed in coupling, making a clean, firm contact. The wires are run under the bottom of the cars and through the hose to the couplings.

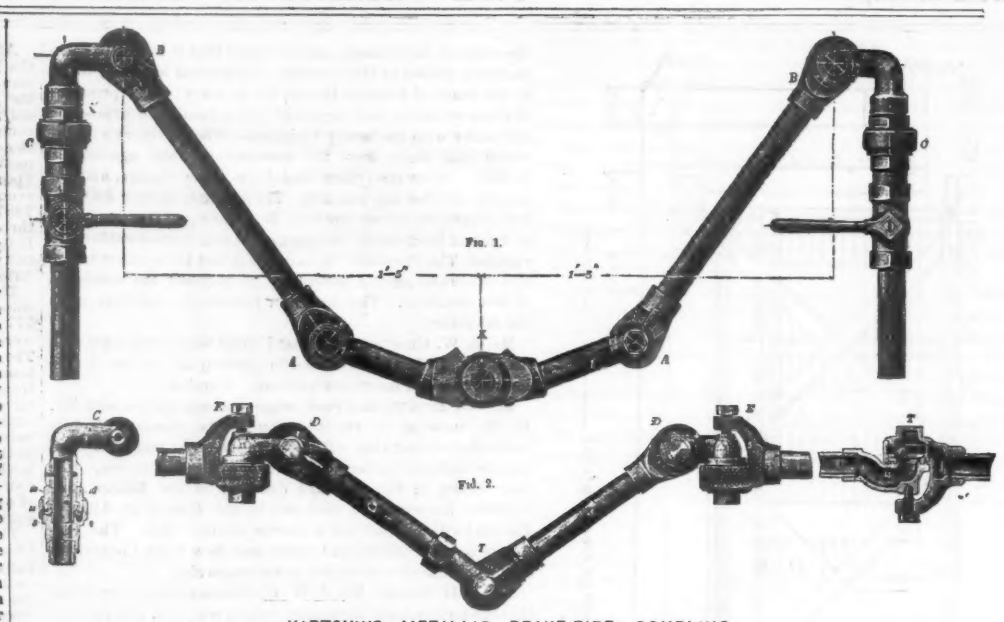
The resistance of each electro-magnet was found to be 200 ohms, making for a 50-car train, when connected as shown, a total resistance of 4 ohms. It is worthy of note that with a battery of constant electromotive force, the resistance being increased inversely as the number of cars in the train, a constant current strength is maintained through each magnet regardless of the number of cars, making no adjustment necessary for different lengths of train.

With this arrangement of battery and resistance, considerable current is used while the circuit is closed, but as this only takes place while the pressure is either being increased or decreased in the brake cylinder, it amounts to but a small consumption of battery, even for a number of stops. Calculations show that with a 50-car train the braking force could be increased or decreased continuously for about 17 hours before the strength of the battery would be destroyed, and a proportionately longer period for a shorter train. From the way in which the circuit is run it is easily seen, that should an accident happen to any of the wires, causing a rupture at any point, the brakes between such point and the engine would be unaffected thereby, while those on the other section would of course be inoperative. This feature would enable the brakes on the forward section to be released by the engineer in case of an accidental break in two. We found the conducting wires used fairly well insulated throughout their length, except at points where connection was made between wires to valves and the main conductors. No attempt at insulating of these joints is made. Perfect insulation is of great importance in this system, for, should a cross occur between the two conductors, instead of the brakes being applied when an attempt was made to do so, the release, as well as the admission valves, would be open, and should the current be maintained the auxiliary reservoir, the train-pipe and the main reservoir would all be completely bled. Should either wire come in contact with any metallic connection, either with the train pipe or any of the braking apparatus, or any part of the car forming metallic connection with the track, the result would be that either the admission valves would cease to operate by electricity and the brakes could not be set thereby, or, being set, they could not be released, depending upon which wire was touched or grounded. Rain, sleet or snow would work very much to the disadvantage of the electric appliances of this brake if the conducting wires are not well and completely insulated. It is perhaps fair to say that this brake can be applied by allowing air to escape from the engineer's valve in case the current fails, but cannot be released except by electricity. In regard to details, we found the electric appliances admirably designed and well worked out, giving, in our opinion, under ordinary circumstances, a good and reliable arrangement. The magnets and armatures are inclosed in the cast-iron cap on top of the valve, but are not within the compressed air chamber. They are separated from the rest of the valve by a heavy brass plate serving to protect the armatures from the magnetic influences of the the other parts of the valve. The amount of current used on a 50-car train is about 3 ampères with an electromotive force of 16 volts, the resistance of the circuit being about 5½ or 6 ohms. Fusible safety plugs are inserted in the circuit next the battery to prevent the possibility of the magnets being burned.

The next in order is the Card electric brake. This company uses two secondary batteries of a form devised by the inventor, Mr. Card, consisting of 15 cells each, one situated under the engineer's seat on the engine, the other on the rear car of the train, so connected as to oppose each other in such a way that no current passes under normal condition; also a system of 3 electro-magnets for each brake, connected in multiple series, together with an automatic rheostat current indicator and arrangement for cutting in and out as many cells as is desired to give the required braking force. [The diagram of the electrical system and connection will be given later.—ED.] The automatic rheostats are arranged in such a way that should the train part at any point, the couplings for the wires being so arranged as to close the circuit on each section, thus cutting off part of the resistance before in circuit, an equal resistance would be automatically inserted at the rheostat. This maintains the current at a constant strength no matter how many or how few cars are broken off. The brake is applied while running, by either the conductor or engineer moving a handle and thus cutting in or out some of the cells, destroying the balance and causing the current to flow through the magnets, the amount of flow and consequent severity of application of the brakes being regulated by the number of sections over which the handle is moved. The resistance of each magnet is low, being one ohm, making the resistance of the three used in each car ⅓ ohm when connected as shown. The total resistance of each car including wires is ½ ohm, or a total of 25 ohms for a 50-car train. Although considerable current is required for the full application of the brakes, only part of it is necessary for a partial application. The current is passing in this system while the brakes are in operation, for not only must the current pass to apply the brakes, but it must be maintained to keep them on. Calculation shows that with the battery used of a capacity of 10 ampère hours, 10 hours of the maximum application of the brake could be obtained before the battery is exhausted, and, of course, a proportionately longer period for gentler applications.

The conducting wires used by this brake company are not insulated excepting where they are fastened to the body of the car, and consist of galvanized iron wire cables ⅛ in. thick. The couplings are arranged to complete the circuit through one wire by a sliding contact piece in the centre, the return current passing through the outside casing of the couplings. They are designed to pull apart at the couplings under all circumstances, for should the hose and contained wires be ruptured, the brakes on another section could be applied. The effect of a cross between the conducting wires here would be to apply the brakes throughout the train, and as no effort has been made to insulate the conducting wires, this is an accident which, in our opinion, is extremely likely to happen to either from the direct contact, or by rain, snow, sleet or other causes. The automatic rheostat is also a delicate piece of mechanism liable to get out of order, with the possible result of burning out some of the magnets, rendering the brake inoperative. The principle on which this brake is gotten up is admirable, but the mechanism employed somewhat complicated for train service.

In the second division we have first the Westinghouse automatic air brake. The electric device used by this company consists essentially of a valve inserted in the train-pipe, operated by means of compressed air, which raises a piston normally in equilibrium when its balance is destroyed by blowing off a chamber above it by means of a small valve raised from its seat by the armature of an electro-magnet. The current which energizes this magnet is produced by 6 Leclanché cells situated in the box under the engineer's seat, the current passed through a copper wire insulated with rubber insulation and run through the train pipe, the return being through the metal of the pipe itself. The wire is connected automatically in coupling the air hose by means of contact pieces in the centre of the coupling, giving a firm contact with a slight rubbing between the surfaces. The magnets used are wound to a resistance of 11 ohms each, and



KAPTEYN'S METALLIC BRAKE-PIPE COUPLING.
Made by the WESTINGHOUSE BRAKE CO. (Limited), *London.*
(*For description see page 405.*)

but three being used in these tests, connected, as shown in diagram below, in multiple, the total resistance, about 3⅓ ohms for the magnets and about 2 ohms for conducting wire, is 5⅓ ohms. The battery used would suffice for a long time, as the wires are so connected to the engineer's valve that no electricity would be used except for emergency stops. The wires are carefully insulated, and being inclosed in the train pipe are well protected from the effects of the weather. Should a metallic contact occur between the wire and the pipe, however, the result would simply be to render inoperative the electric valves, which as before stated are entirely auxiliary to the brake mechanism. The electric features of this brake are well worked and in our opinion give a reliable and practical apparatus.

The electric appliances to the Eames automatic vacuum brake are also auxiliary to the vacuum mechanism itself. It consists essentially of any electro-magnet inclosed in a cast-iron cap or chamber, which can be put in communication either with the vacuum of the main valve and auxiliary reservoir or with the atmosphere according as the circuit is made or broken, as explained on page 24 of the Eames catalogue; also a metallic circuit composed of a single conducting wire and the magnets connected as shown in red on the cut submitted herewith, the return being through the rails of the track. The current is supplied by a small dynamo having an armature 9 in. long and 3 in. in diameter; this dynamo has no governor, and is entirely beyond control and varies greatly in speed. The magnets, as is seen, are connected in series, making the total resistance equal to the sum of the resistances of the conducting wire and all the magnets, necessitating a very low resistance in the latter, ½ ohm each, and a current of considerable strength to overcome the entire resistance, which is, for a 50-car train, about 30 ohms. The conducting wire is fairly well insulated, and being run through the train pipe is well protected except where it is connected to the spiral wire through the hose. The effect of any metallic contact between the conducting wire and the parts of the car in metallic connection with the track would be as far as the electrical attachment is concerned to cut out all brakes between the point of such contact and the rear of the train. If the conducting wire be broken or detached, in any way causing a break in the circuit, the entire electric apparatus fails. No effort was made to protect the armatures from the effect of close proximity of iron in the other parts of the valve, and in several ways the details of the electric attachments might be improved. The use of the track as a return is to be deprecated on account of interruption to the current in case of insulated track sections put in block signal systems, and of draw-bridges.

It seems to us the whole question of the application of electricity to railroad braking resolves itself into three important questions:

First, can a valve mechanism be made operative by electricity which shall be permanent and practicable for railroad service, not having parts too sensitive or of too fine adjustment? We think it can. The valve construction as shown by Mr. Carpenter, the same which he used in these trials, is certainly more delicate and complicated than that of the well-known Westinghouse triple valve.

Secondly, can the electrical conductors for working these valves be so insulated and protected as to avoid short circuits and other injuries? We think they can by running the wires inside of the air pipes, where they are as little liable to derangement and injury and become as permanent and certain in their functions as any other feature of the brake mechanisms. In all the electric brakes shown, the wires are laid inside the air hose couplings, where they are fully protected and their connections are made from car to car easily and certainly, so that this important point is so far settled as to require no further explanation.

The remaining point is the source of electromotive force.

Of the different means employed by the companies represented, the secondary battery appears the most reliable, giving a constant current at all times until discharged, recharging being a simple process which can be so methodically and practically arranged as not to interfere with the brake service, nor add materially to the expense.

If brakes worked by electricity are to come into general use, it is probable that both battery and dynamo will give way to the magneto generator, being a small machine about 18 in. square, having an easily turned crank which instantly develops the electromotive force required, so that a turn of the crank will actually apply or release the brake. One of these machines was shown us in operation upon an engine and tender brake. This apparatus may solve a most important point connected with the application of electricity to railroad brakes, inasmuch as it renders the apparatus on the locomotive independent of any special stations or round-houses or any stated period when a battery, if used, would have to be recharged.

We believe from what we have seen at the Burlington brake tests, and from a close personal examination of the several electrical arrangements for braking, that electricity properly devised and managed may be made a valuable auxiliary to actuate power brakes on long trains, and their efficiency considerably increased thereby. [Signed by the Sub-committee.]

In addition to the tests prescribed at Pittsburgh in February, 1887, during the progress of the contest, engine tests were made, passenger train tests and old train brake tests. These will be described in our later report. For the present we have been obliged to confine ourselves to the 50-car trains.

The trials were opened May 9 by going through some necessary preliminary tests, the Westinghouse brake, May 13, commencing the general tests with a 50-car empty train. Three stops were made on level, resulting as follows:

50 WESTINGHOUSE EMPTY CAR TRAIN, 1887.

Automatic air brakes.

No. stop.	Speed. Miles.	Distance. Feet.	Shock. Inches.	Time. Seconds.	Distance correct'd for speed and grade. 20	40
511	19½	186	103	9¾	196	....
521	19½	215	70¾	11	233	...
522	36½	588	70½	17	....	693

These stops may be regarded as phenomenal in their shortness, which becomes all the more evident when we compare them with the best results obtained in 1886:

50 WESTINGHOUSE EMPTY CAR TRAIN, 1886.

Automatic air brakes.

No. stop.	Speed.	Distance.	Shock.	Time.	Equivalent distance. 20	40
621	23.5	424	Not taken.	17½	307	....
611	20.3	354	"	16	340	....
622	40	922	"	22¼	....	922
612	40	927	"	22¼	....	927

The brilliancy of the record, however, was completely spoiled by the fearful shock given at the rear end, the slide-ometer moving, it will be observed, from 70 to 103 inches. The same train was then tested electrically, with the following results.

50 WESTINGHUUSE EMPTY CAR TRAIN 1887.

Electric application.

No. stop.	Speed. Miles.	Distance. Feet.	Shock. Inches.	Time. Seconds.	Equivalent distance corrected for speed and grade. 20	40
611	21½	160	None.	7	139	....
531	23	183	"	8	138	...
612	38	475	"	14¼	....	519
532	36½	460	"	14	....	545

Now comes the still more astonishing story. In these electrical stops the slideometer never moved, and this with the same cars, the same leverages, and the same pressures, the only difference being the time of application. Without electricity the application commenced on the rear car in from 5 to 6 seconds; with the electric application it was practically instantaneous on every car in the train.

The main results of the other 50-car trains are shown on the table accompanying this report. This table deals only with the average results made by the Carpenter, Eames and Westinghouse 50-car trains, emergency stops. It will be observed that the Eames is the only train going through all the tests prescribed both with its atmospheric and electric appliance. The results achieved by the Hanscom and Card brakes are not given, as their cars were withdrawn early in the trial, but they will be considered in our complete report. This table shows the average results obtained by each class of brake in five different classes of stops, and at two speeds for each class of stop. The classes of stops are as follows:

1. 50 empty cars, brakes applied by air.
2. 50 empty cars, brakes applied by electricity.
3. 50 mixed cars, brakes applied by electricity.
4. 50 mixed cars with slack shoes, brakes applied by electricity.
5. 50 mixed cars, brakes applied by air.

The table shows the name of the brake, the distance in which the stop was made, corrected for uniform speed, which is also given on level and grade; the time in which the brakes became fully applied and in which they were released is also given. The weight of the train in tons of 2,000 lbs., and the percentage of that weight which was braked is given, and the pressures. The movement of the slideometer indicates the severity of the shock experienced in the rear car; shocks above 12 inches are considered as objectionable, and likely to injure live stock and many classes of freight. It may be noted that the Westinghouse train was equipped with the Janney coupler; owing to the severity of the shocks, two of these were broken during the trials. The Eames train was equipped with the Boston, which is of the vertical plane type also; two of these couplers were also broken during these trials. The Carpenter train was equipped with the ordinary link and pin draw-bar, which was not wedged up during the great majority of the trials and suffered no damage. The casualties due to the continuous brakes were inconsiderable as compared with last year, and show in the strongest possible way the benefits that may be obtained in freight train service by more efficient brakes, together with the elimination of the slack from the couplings.

AVERAGE RESULTS BURLINGTON FREIGHT BRAKE TESTS 1887. DISTANCES CORRECTED FOR SPEED AND GRADE.

EMERGENCY STOPS.

Note: The distances given are for the exact speeds noted and for level grade.

Kind of Stop.	Name of brake.	Speed...	Distance	Time. From brake applied by engineer. Rear car. Brakes begin to apply	Time. From brake applied by engineer. Rear car. Brakes fully on	Time. From full stop. Brakes off rear car	Time. From full stop. Train moving.	Time. From release signal till full release rear car	Number cars released by hand	Total weight engine, cars and load	Per cent. braked	Pressures. Before stop train pipe.	Pressures. Cylinder rear car	Pressures. Brake beam pressure per cent. weight empty car	Slidometer movement, rear car	Couplings broken	Miscellaneous brake casualties.	Wheels slid, distance
		Miles.	Feet.	Seconds.	Seconds.	Seconds.	Seconds.	Seconds.		Tons.		Lbs.	Lbs.		Inches.	No.		Feet.
50 empty cars, air	Westinghouse	20	214	5			34		No.	866	83.4	20½			70⅝ to 103	One.		30
		40	683	6					One.	846	95.0	73½			70⅝	One.		
	Eames	20	300	11		19⅝	54⅝	19	One.	743	94.5	20	12	91.4	18⅛ to 25⅛			230
		40	910	11		19⅝	107	19¾	Two.			19	10½	91.7	15⅝ to 23¾			
50 empty cars, electric	Carpenter	20	111	1⅛	4	1⅛	73	1⅛	One	766	95.1	64	33½	98.5	None.			5
		40	450	1⅛	4½	2	69	1⅛	Six.			61	37½	100	None.			
	Westinghouse	20	193	⅛	3½	38	140	33½	Six.	846	95.0	73	.....	.....	None.			7
		40	505	⅛	3½	40½	106½	39¾	Two.			75½	.....	.....	None.			
	Eames	20	258	3	9	16¾	287	15⅝	None.	739	49.3	82	60½	106.7	¼ to ¾	One	Dynamo and electric appliances gave considerable trouble, finally necessitating giving up a run.	180
		40	614	2¾	7	8	82	8				83	61	97.4	0 to ⅛			
50 mixed cars (33 loaded 17 empty), electric	Carpenter	20	169	1	3½	1	124	⅝	Three.	1,405	49.1	20½	12	92.5	None.		Four cars cut out for defects in electric valves, and one on account of broken brake rod.	160
		30	442	1	4	1⅛	113	1⅛				20	11	97.8	None.			
	Westinghouse	20	183	⅛	3½	59½	152¼	57¼	One.	1,041	49.3	82	60½	.....	None.		Brake would not release on one car, which was bled.	10
		30	438	⅛	4	79¾	400	74				83	61	.....	None.			
50 mixed cars (33 loaded 17 empty), electric	Eames	20	242	1⅛	6½	14	97	.....	Six.	1,389	49.1	20½	12	92.5	None.		Difficulty in releasing owing to low boiler pressure (103 lbs.) engine, six cars bled.	200
		30	516	2¼	7¼	14	154	12				20	11	97.8	None.			
50 mixed cars (33 loaded, 17 empty), slack shoes, electric	Carpenter	20	133	1	3½	8	462	7¾	Several.	1,480	48.6	81	43½	123.2	0 to 3½		Electricity failed to stop train owing to careless connection of wires on engine. One brake rod broken	175
		30	324	1	4½	8	168	8				74	48½	119.2	2½			
	Westinghouse	20	178	¾	4½	51½	146	50	None.	1,641	49.3	85	63½	.....	None.			175
		30	456	1	5	67¼	162	48½				83	61½	.....	None.			
Ditto, air	Eames	20	416	12	18	24⅞	236	24	None.	1,399	48.8	20½	12	.....	6 to 7	Two.	Two hose became uncoupled owing to being too short and the load of wheels in two cars shifted	
		30	751	12	24	34½	576	28				19½	11	.....	0 to 5½			400
50 mixed cars (33 loaded, 17 empty), air	Eames	20	407	11	15½	26¼	123	26	None.	1,380	49.5	20½	12	97.6	3½ to 5½			
		30	796	11	17½	35¾	177	35¾				19¾	11½	95.0	2 to 7¾			

NOTES.—Train pipe pressures are an average of those on engine and rear car. There was often from 5 to 10 lbs. difference in pressure between engine and rear car. Cylinder pressures given are on rear car, and are often considerably lower than those on front parts of train. Brake beam pressures are calculated from diagrams from Boyer Speed Recorder on middle car of train.

Conclusion.

At the conclusion of the 1886 trials, the Committee felt that to sum up any results in the face of so large a field for improvement could not but be unsatisfactory, and, while a wonderful advance has been made in the brake problem, as will be seen by a comparison of the stops of each year, the 1887 tests apparently leave the field for improvement open as wide as in 1886. The Widdifield & Button and Rote Buffer brakes hopeful over the shocks given by the atmospheric brakes are fitting up trains to pursue their investigations. The Westinghouse Co. loath to accept the teachings of 1887, is making changes in valves and piping, by which it hopes to make 50-car emergency stops without the aid of electricity. The American Buffer Brake Co. convinced that buffer brakes cannot compete with continuous ones, is about testing a 50-car train fitted with a new electro-atmospheric brake.

While we are not prepared to make any definite recommendation at this writing as to what freight train brake should be adopted, our present information, derived from the recent tests, point to two conclusions:

First. That the best type of brake for long freight trains is one operated by air and in which the valves are actuated by electricity.

Second: That this type of brake possesses four distinct advantages:

a. It stops the train in the shortest possible distance.

b. It abolishes shocks and their attendant damage to equipment.

c. It releases instantaneously.

d. It can be graduated perfectly.

The further question as to whether electricity is a sufficiently reliable element to use in freight train service can only be determined by experiment, but we think the benefits derived from electricity are so manifest that the experiment is well worth trying. In view of the foregoing and of the improvements that the buffer and atmospheric brakes are making, your committee recommend that the subject of automatic freight train brakes be continued for further investigation.

THE RESISTANCE OF TRAINS.

The following figures give briefly the results of the No. 7 special tests made to determine the frictional resistances of the various trains. The trains were composed of 49 or 50 empty cars with dynamometer and way car and American type engine and tender. The track and rails were in good condition and the wind light.

Each train was tried once on a slightly descending tangent, and once on a curve, situated on an average descending grade of 50.6 ft. per mile. The resistance was ascertained on the tangent by running up to stop-post No. 1 at about 20 miles per hour and then shutting off steam and allowing the train to run until it came to a standstill. The resistance on the combined grade and curve was ascertained by running the train up to stop-post No. 3 at a low speed (about 5 miles per hour), and then shutting off steam and allowing the train to run until stop-post No. 4 was reached. The speed at the moment of passing each stop-post was carefully noted. It will thus be seen that the resistances given below include, not only the resistance of the cars, but of the engine running without steam. This is probably greater per ton than that of the cars, but the weight of the engine (about 40 tons) is so insignificant in comparison with that of the cars (700 to 800 tons) that the influence of the engine in running without steam may be neglected, and the resistances given may probably be taken to represent fairly the resistance of new empty cars.

1887.

		Tangent. Speed per hour. Average. Miles.	Tangent. Speed per hour. Mean. Miles.	Tangent. Resistance per ton of 2,000 lbs. Pounds.
Pattern of cars.	Brake.			
Pennsylvania	Westinghouse.	15	15	5 87
Illinois Central	Carpenter.	14¼	15	6.22
C., B. & Q.	Eames.	11½	14¾	7.51
St. Jo & St. L.	Hanscom.	11⅛	15	12.00
Average		13¼	15	7.90

		Curve. Speed per hour. Average. Miles.	Curve. Speed per hour. Mean. Miles.	Curve. Resistance per ton of 2,000 lbs. Pounds.
Pattern of cars.	Brake.			
Pennsylvania	Westinghouse.	19	23¼	8.72
Illinois Central	Carpenter.	15¾	24¾	9.09
C., B. & Q.	Eames.	13¾	20	11 00
St. Jo & St. L	Hanscom.	4	4	19.80
Average		16¾	22	9.60

In making this average, the Hanscom results on the curve are excluded, as they are not based on sufficient data to be trustworthy. The "mean speed" is the average of the squares of the speeds.

The cars were new, and were tried empty. The Pennsylvania cars were lubricated with dope. The Eames cars when loaded, after these trials, gave trouble from hot boxes. The great resistance of the Hanscom train was caused by the brake-shoes binding on the wheels. The brake-shoes on the Eames train were also in some cases very close to the wheels and apparently affected the friction of the train on the curve. The brake-shoes on the Westinghouse train were hung inside; all the others were hung outside the wheels.

The trials on the curve were made between stop-posts 3 and 4. About half the total distance is on a 2 degree 40 minute curve (2,149 ft. radius), extending over nearly a quarter of a circle (80 deg. 40 ft. 10 sec.), and the remainder of the distance is on curves averaging about one degree, or say about 6,000 ft. radius.

The results given in similar trials of brake trains over the same ground in 1886 were as follows; the trains were, however, composed of 25 cars, 12 loaded to their full capacity and 13 empty:

1886.

Pattern of Car.	Brake.	Tangent. Av'r'ge speed. Miles p. hour.	Tangent. Resistance per ton of 2,000 lbs. Lbs.	Curve. Av'r'ge speed. Miles p. hour.	Curve. Resistance per ton of 2,000 lbs. Lbs.
C., B. & Q.	Westinghouse	20½	4 32	26¼	6.07
L., D. & S.	Eames	16¾	6 84	21⅜	9.42
Lehigh Valley	Widdifield & B.	16¾	6.84	21⅜	9.42
St. Louis & S. F.	American	11½	8.50	21¼	8.94
Average, 1886		16¼	6.62	22¾	8.46
Average, 1887		13¼	7.90	16¼	9.60
Av. of both years		14¾	7.26	19⅛	9.03

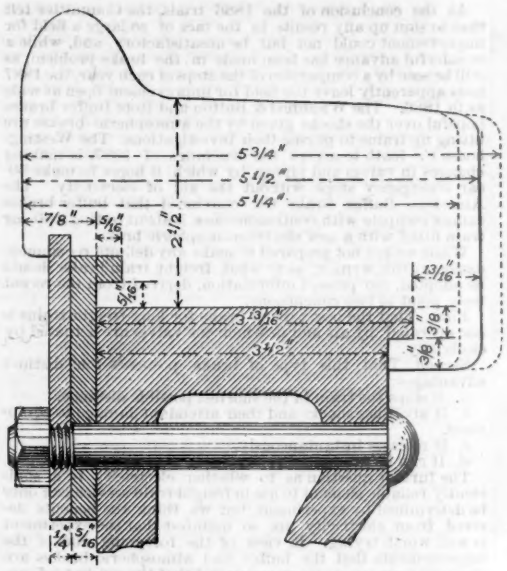


Fig. 3.—No. 3 Tire Lock.

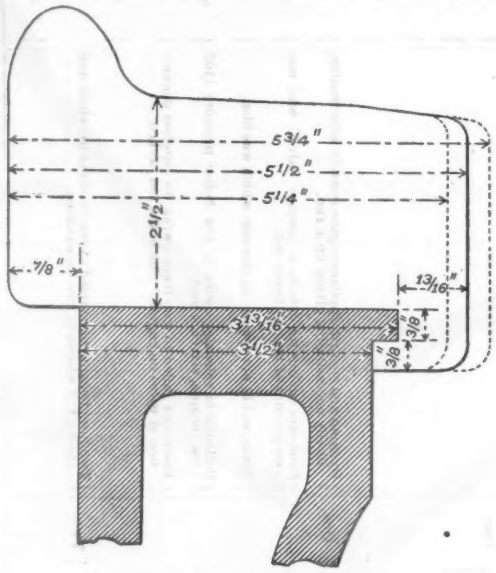


Fig. 2.—No. 1 Tire Lock.

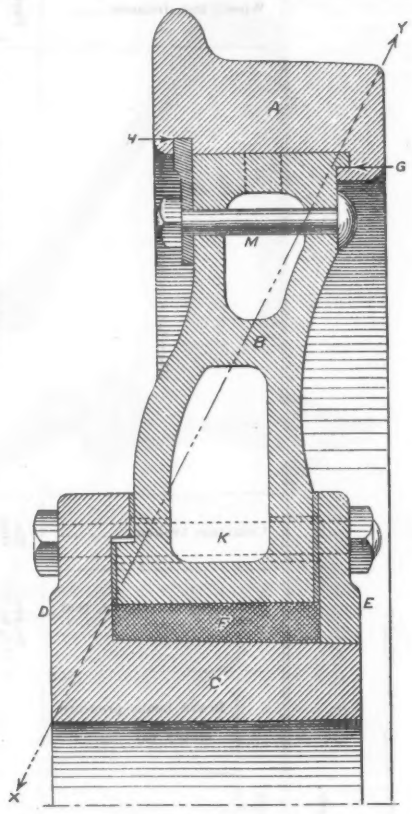


Fig. 1.—Showing No. 2 Tire Lock.

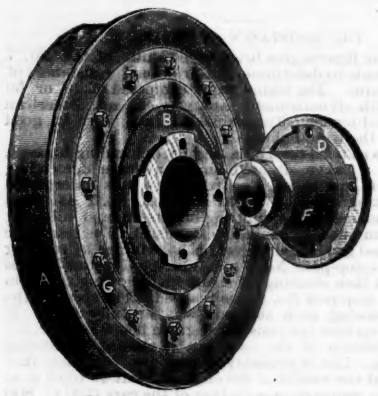


Fig. 4—Perspective View.

THE PECKHAM CUSHIONED CAR WHEEL.
(*For description see page* 405.)

The committee are indebted to Mr. A. M. Wellington for the calculations giving the results of the trials in 1886.

The results for the two years agree fairly well. The average difference between the resistances on the tangent and on the curve was 1.84 lbs. in 1886 and 1.70 lbs. in 1887. One train of cars (Westinghouse, 1886) gave a resistance of only 4.32 lbs. on the tangent, while another train (Hanscom, 1887) had a resistance 12.00 lbs. per ton on the tangent, or nearly three times that of the Chicago, Burlington & Quincy cars in the lighter running train. This difference was apparently principally due to the brake-shoes rubbing against the wheels, and was equal to a constant grade against the train of 20 ft. per mile. In running from New York to Chicago, 1,000 miles, the extra resistance would be thus equivalent to surmounting an elevation of 20,000 ft., or more than the height of the highest mountain in North America. The importance of keeping the brake-shoes clear of the wheels is thus very evident. In the 1886 trials the Chicago, Burlington & Quincy, the Indianapolis, Decatur & Springfield, and the Lehigh Valley trains were composed of cars that had been running some time. The St. Louis & San Francisco cars were new. The Chicago, Burlington & Quincy cars (Westinghouse) had the brakes hung from the trucks and inside the wheels. All the other cars had the brake-shoes hung outside from the body. The following figures, based on the average results obtained in 1886 and 1887, show the increased friction on the curve as compared with the tangent.

	Increase lbs. per ton.
Shoes hung from the truck and inside the wheels.....	2.30
Shoes hung from the body and outside the wheels....	2.84

These results tend to show that the resistance on curves is increased considerably when the shoes are hung outside and too close to the wheels. When the truck swivels, the shoes, being hung from the body, are lifted and brought closer to the wheels by the greater inclination of the hangers. When the shoes are hung from the trucks, no such action occurs, and the shoes remain the same distance from the wheels, whether the car is running on a tangent or on a curve. The fact that outside-hung shoes rub more forcibly against the wheels on curves, is not only shown by the figures given above, but was also observed when the trial trains were being hauled over frogs and curves in the yard at West Burlington.

The size of journal bearing has doubtless an important influence on the friction of trains, and the subjoined figures give the sizes of the journals in three of the trains tried at the 1887 tests, together with the weight of each car, empty, and loaded to its full marked capacity, and the resultant load per sq. in. on the journals. The bearing area of the journal is assumed as the length and diameter multiplied together.

Cars.	Journal length and diam. Inches.	Weight of car. Empty. Lbs.	Weight of car. Loaded. Lbs.	Pressure per sq. in. on journal. Empty. Lbs.	Pressure per sq. in. on journal. Loaded. Lbs.	Friction tangent. Lbs.
Pennsylvania.	8 × 4	30,577	90,577	119	354	5.87
Illinois Cent...	7 × 4	27,351	67,351	122	301	6.22
C., B. & Q.....	7 × 3¾	25,509	65,509	121	312	7.51

As the frictional resistance given was obtained with empty cars, where the load per square inch on the journal is practically identical, the variation found in the resistance is due to other causes than insufficient bearing surface. The highest amount of friction was shown in 1887, by the Chicago, Burlington & Quincy cars, which, in 1886, showed the least. In both years the cars were of the same design, but, in 1887, the cars were new, whereas, in 1886, they had run over 10,000 miles. The difference was therefore probably due to less accurate fitting and workmanship as compared with the Pennsylvania and Illinois Central cars, which were also new, but showed respectively 1.64 and 1.29 lbs. per ton less friction than the Chicago, Burlington & Quincy cars. These differences, insignificant as they may appear, would, in running 1,000 miles, necessitate an extra amount of haulage power equivalent to surmounting summits 4,330 and 3,415 ft. high respectively, or greater than that of any line between the Mississippi and the Atlantic. The importance of good fitting is further shown by the Cbicago, Burlington & Quincy cars running hot when loaded after the resistance tests. The Pennsylvania and Illinois Central cars were built at the companies' shops, and the Chicago, Burlington & Quincy cars were built by a contractor.

Your committee believe from these experiments that the following figures represent the frictional resistance of long trains of freight cars in good repair running over a track in good condition, the weather being fine and warm and the wind light. The resistance appears to be constant at speeds of from 12 to 25 miles per hour, and does not appreciably increase with an increase of speed within these limits.

FRICTIONAL RESISTANCE, POUNDS PER TON OF 2,000 LBS.

Speeds 12 to 25 miles per hour.

	New cars. Lbs.	Old cars. Lbs.
On tangent.....	8.00	6.00
On 3 degree curve.....	10.50	8 30

Good lubrication and carefully fitted boxes and journals may, with cars that have been running some time, decrease this resistance to a minimum of 4 lbs. per ton on the tangent, while brake-shoes rubbing against the wheels and other unfavorable conditions may increase the friction on the tangent to 12 lbs. per ton, and to considerably more on curves. The use of outside hung shoes seems to increase the resistance on curves when the shoes are very near the wheels.

Mr. E. B. WALL moved that the report be accepted, the committee continued, and that the committee receive the warmest thanks of the association for their labors. Carried unanimously.

Mr. J. W. CLOUD asked if electrical appliances can be cheaply added to engines now fitted with the Westinghouse brake. Mr. Rhodes said yes. Mr. Cloud also asked if the Carpenter brake can be used with this alone. Mr. Rhodes replied that as tested at Burlington the Carpenter cannot be used without electricity. Mr. Wall suggested that Mr. Carpenter be asked to explain whether by any modification he could operate his brake by electricity. Mr. Cloud thought any statement as to the performance of the brake should be substantiated by a record of tests. Mr. W. Forsythe moved that Mr. Carpenter be invited to explain whether his brake can be operated by air. Messrs. Cloud and Rhodes opposed the motion, which was lost, and the discussion closed.

Mr. E. B. WALL then read a final report of the Executive Committee on Freight Car Couplers.

REPORT OF THE EXECUTIVE COMMITTEE ON AUTOMATIC FREIGHT CAR COUPLERS.

Your committee is prepared to make a final report on automatic freight car couplers. In order that all the reasons which have led to their conclusions may be brought before you, and in order that our superintendents, managers and presidents vitally interested in this question may thoroughly understand and appreciate the results of our conclusions, we will review the course which the Master Car-Builders' Association has followed with this problem, endeavoring to divest the report of such technicalities as might encumber its meaning with our superior officers.

The Master Car-Builders' Association has been criticized by the technical papers and by the coupler men on account of the time it has spent in the consideration of this subject, but we think it will be apparent that this time has been well spent, and that most disastrous mistakes would have been made if a solution of the question had been attempted before we had the information now at our hand. The question is certainly the knottiest mechanical problem that has ever been presented to the railroads collectively. Over four thousand attempted solutions have been recorded by individuals in the Patent Office, and one of the great complications of the problem is evidenced by the fact that the difficulty has not been to find the best coupler from a large number of meritorious devices, as might reasonably be supposed from experience with other inventions made in such vast numbers, but to find even one device which did not possess grave disadvantages. The question of strength alone has necessitated metallurgical investigations of the most searching character, and we would not be surprised if it ultimately required the invention of an entirely new material. The conditions of the problem have been greatly changed since its inception by the increase in weight of cars and locomotives, the length of trains and the speeds at which they are scheduled. Opinion has altered with these changes, and automatic couplers are no longer expected to cost the same or less than bullnoses. Railroads are prepared to pay for improvements that cut down their operating expenses.

The state legislatures have attempted in several states solutions of the problem, but their action while prompted by the most humane intentions, has really increased the complications, for they have opened the door for many varying kinds of couplers to get into service with a certain official recognition, and trainmen unable to keep pace with all of the details of operation of the thirty-four couplers thus far so approved are more liable to personal injury when these patent couplers are brought together miscellaneously, than with the link and pin device.

The question is national not local, and cannot be satisfactorily solved by independent state laws; the drift of state legislation at the present time is, however, more favorable to an effective solution and entirely in accord with the recommendation which we propose to make; this tendency is not to specify the kind of coupler, leaving that to the railroad companies, but to require that on and after a certain date the railroad companies shall equip their cars with an automatic freight coupler.

The advance of the Master Car-Builders' Association towards a solution of the problem has been in accordance with the doctrine of evolution; for many years devices have been examined, and in many cases, tried as fast as they were developed; the conditions that a coupler should fulfill, and the principles upon which the various forms should operate, have been adduced to you. In September, 1885, forty-two couplers were tested at Buffalo; the requirements of the test were such that the forty-two tested represented but a very small proportion of the actual amount considered. There were in existence at that time some 3,100 patents for car couplers. The requirements were that the coupler should be placed on both ends of two cars and that the cars should be forwarded to the place of test free of charge to the Master Car-Builders' Association. It was therefore necessary that the owner of the coupler should be possessed of sufficient capital to permit him to go to this expense, or friends or capitalists who would come to his assistance, or railroad companies who considered that the device had sufficient merit to warrant them in assuming the expense. These requirements brought to the assistance of the Executive Committee the skill and intelligence of many of the members of the association, who prevented couplers obviously devoid of merit from being attached to cars.

The tests permitted a classification of the different devices then in existence and the consideration of the couplers by classes. On investigation it was found wise to eliminate certain classes entirely, because they involved difficulties in operation peculiar to themselves, while they did not accomplish advantages not found in other more meritorious classes. Representative couplers of the chosen classes were put on special trial, and railroad companies were further recom-

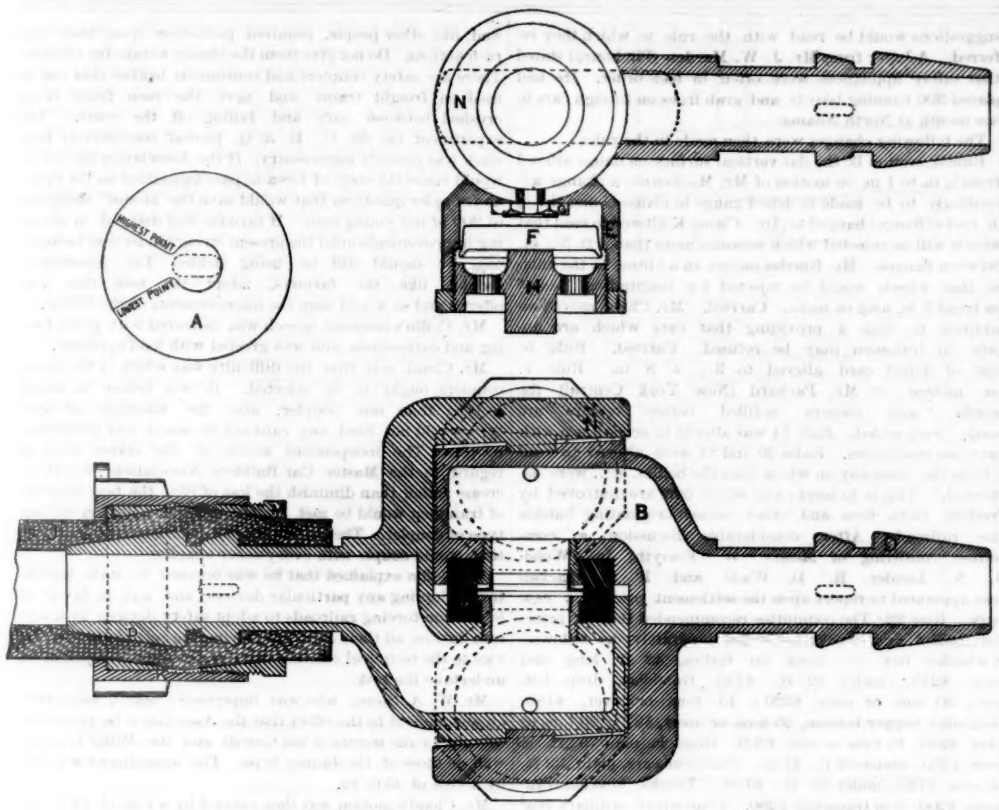


Fig. 1.

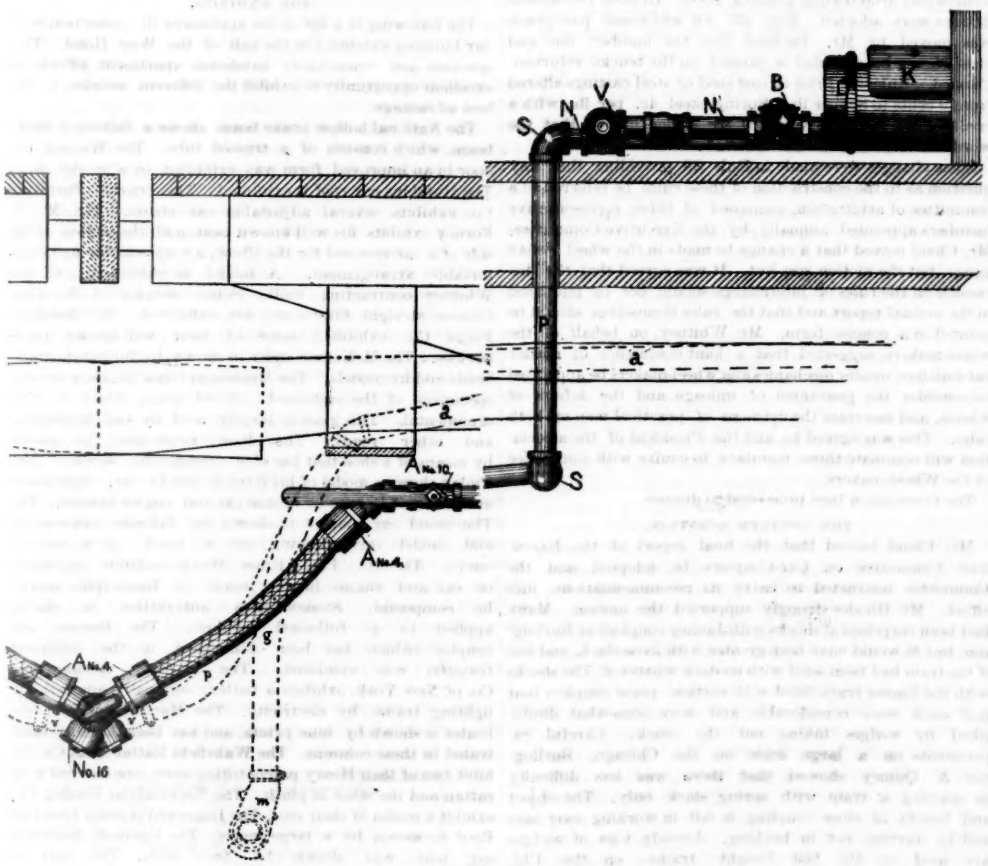


Fig. 2.

GOLD'S STEAM COUPLING, WITH THERMOSTATIC TRAP.

(*For description see page* 405.)

mended to experiment for themselves with these representative couplers. These tests and this method of procedure were important steps in the evolution of the subject, because they raised the question from the endeavor to select one coupler from the great number in existence to a selection of types, as these classes virtually corresponded to types. This advance was very important, because it permits the various railroad companies a range in the selection of what coupler they will adopt, in the event of the type being approved by this association; because it enables inventors to concentrate their abilities on increasing the number of couplers in the preferred type, and devise improvements in those already in existence. It protects railroad companies against extortion, as would be the case if any one coupler instead of a type of couplers, interchangeable among themselves, was the standard of this Association.

At the close of the last convention, your association had before it the consideration of two general types of couplers, loose links, and hooks coupling in a vertical plane: the loose links represented being the Ames, Archer, Gifford, Marks, McKeen and Perry; the hooks being the Cowell, Dowling, Hein, Janney, Thurmond and Titus & Bossinger, with the special recommendation to confine experimentation to the Ames, Archer, Marks and McKeen, and the Cowell, Dowling, Janney and Thurmond. The great and important question still then to be solved, in deciding between the relative merits of the two types, loose links and hooks, was the value of slack; whether a train could be started with equal facility with close coupling or loose links; whether the damage in starting and stopping trains, and at sags and hollows, incident to loose slack, could be overcome; whether the slack, due to the presence of loose links, would interfere with the use of train brakes.

By far the most valuable contribution to the solution of these questions, made during the past year, has been in the discoveries and discussions of the results of the Burlington Brake Trials. Your association is indebted not only to the Brake Committee and its able chairman for the information given us in train braking, but for the light that has been thrown on the effect of slack as determined in the brake trials proper, and subsequent trials made specially for the purpose.

It has long been thought absolutely necessary that there should be a considerable amount of loose slack in the coupling of cars, to enable the starting of trains, and while it has been tacitly admitted that there were some disadvantages incident to the presence of this slack, due to its tendency to break draw-bars and draft rigging in starting and stopping of trains, and in pulling through sags and hollows in the track. It was never realized what an enormous evil the presence of this slack became on long trains until these trials were made. It was then found that the shocks were so terrific that it was absolutely necessary to block the links; without blocking it was impossible to live in the rear cars; stock could not stand on their feet in such a train, or freight be prevented from shifting except in the case where brakes were applied to each car by electricity. There was only one train-brake present wherein the brakes were applied in this way, and even with this brake it was found necessary to block the links in making the break-away tests, as it was then impossible to use electricity on the rear portion of the train. At best this special train could not be considered as representing the usual conditions of service, because the cars were all of one standard, and were all new and in perfect order. If the train had been made up miscellaneously of home and foreign, and old and new cars, as is usual in service, it is fair to assume that the absence of shocks would not have been so apparent. The tests therefore conclusively show that power train brakes cannot be successfully introduced unless close couplings are used, except in the one case where they are applied electrically to every car in the train and no breakaways are expected. The presence of loose slack having been found to be so dangerous at Burlington, the Brake Committee determined to dispense with it, in so far as possible, in making their tests. Before doing so they ascertained by actual experiment whether its substitution by spring slack would prevent the starting of an equal number of cars, as was generally believed. In this special test they demonstrated that the severest pull on the engine comes immediately after all the cars in the train have been started, and that an engine will start more cars than it can pull; loose slack and spring slack were both shown to assist in moving the train for the first few feet, but the heavy pull on the engine comes after the slack is all out of the train; they found that there was very little difference between the ability of an engine to start a train with loose links or links blocked. Going up a grade of 53 ft. to the mile with close couplings, it was found that a train could be started with greater ease with the links blocked than with the links loose; this was due to the fact that with the loose coupled train, the engine would have had to start up cautiously, in order to prevent the train from breaking in two from the jerks that would follow before all of the slack was taken up. With a close coupled train this care was not necessary, there being no loose slack, and it was possible to start with a wide open throttle. It was also found that the riding of the train was very much improved by the close coupling, as might have been expected from our experience with passenger cars. It should be remarked here, that no form of couplings, loose or closed, entirely abolish shocks of stopping by train brakes, unless they are electrically applied, but that closed couplings are vastly more advantageous than loose couplings; they cushion the shock, and prevent the sharp and distinct blows found with loose couplings. A complete elimination of shocks is a question of brakes, not of couplers.

We have now therefore reached the point in the solution of the problem where we can say that the question which presented itself at this time last year with reference to the value of slack has been decided, and that consequently the choice for this association to make is again narrowed down by a great step from between the loose link and the hooks coupling vertically to the best sub-types of the hooks.

Of the hooks before you for consideration there are the Cowell, Dowling, Janney and Thurmond specially recommended by the association, and the Barnes, Boston, Browning, Hein and Lorraine, which should be included in a report of this character. Four of these couplers, the Janney, Dowling, Thurmond and Barnes, are all of the same general type, the Thurmond and Dowling couple interchangeably with the Janney, and the Barnes, it is claimed (and we believe), can be made to do the same. The Cowell, Boston, Browning, Hein and Lorraine are all independent couplers, and will not couple automatically with any other form of coupler, except in the case of the Cowell, which will couple with the Miller passenger coupler. The Hein is of the same general type as the Janney, excepting that it couples to the left instead of to the right, and thus far its owners have not complied with the recommendation of your committee to change it, so as to couple with the Janney type. These couplers can therefore be classified under the head of Janney type, Cowell or Miller type and miscellaneous. The adoption throughout the United States and Canada of any single individual coupler which would not interchange with any others, we should consider most disadvantageous, for the reasons previously set forth; neither could your committee recommend any one coupler as the best, and we further think it would be impossible for the railroads to agree upon one coupler.

The Cowell coupler is an ingenious device upon which much labor and money have been expended. It has been materially benefited by the skill and ability of members of this association, who have experimented with it, but it has not been made sufficiently strong to resist even the ordinary shocks of service; its deficiencies have been pointed out to the owners, and they have not been able to remedy them. Another objection is that the Cowell coupler, in so far as freight is concerned, is an independent coupler which does not automatically couple with any other device.

The Janney type of coupler, including the Janney, Dowling, Thurmond, and we think ultimately the Barnes and Hein, is the type to which the evolution of the subject has brought us; it affords a close coupling with spring slack; it makes it possible to use power train brakes; it already includes several couplers and opens the door to more, so that no railroad company is restricted to purchasing from one manufacturer; it incorporates more of the practical requirements of a perfect automatic train connection than any other type or form of coupling. It is not a new, unknown and untried coupler, it has been used in the Janney form very extensively on some of our largest roads in the North and West, and in the Thurmond form in the South. Its most serious defect is in strength, and the question that now presents itself is, "Can this defect be remedied?" We consider that it is remediable, and the further development of the problem must be in this direction; and what we say here on the subject of strength is applicable to all forms of couplers, no matter of what type. This development can be accomplished by following three paths:

First: Increase the dimensions.

Second: Improve the character of the material.

Third: Protect the coupler by dead-woods, or better still, spring buffers.

The development in the line of the first path must stop before interchangeability is destroyed; this limit, except possibly in some minor details, has practically been reached. In the second path much remains to be done; its advance has already been marked by transitions from cast to malleable and wrought iron, and in some cases from malleable iron to cast steel. Experiments are now being made on a large scale with manganese steel, and we are hopeful that the general attention being given to the improvement of the material will result in valuable discoveries. The third path, protection, promises the most important benefits, although we believe all three paths should be followed. It is daily becoming more apparent that we cannot consistently expect the small detail parts of a coupler to act as a buffer between such ponderous bodies as heavily loaded freight cars brought into sudden conjunction. Though these parts are designed to operate together in forming a coupling, they cannot successfully perform this function in a satisfactory manner and be the first to receive the whole force of the blows of service. These shocks should be received immediately upon that portion of the car strongest to resist them—the end sills, backed by all the floor fram-

ing in the car. Another line of development which should be mentioned here is the simplifying and standardizing of the levers, rods and chains used for operating the various forms of couplers.

The committee feels that the status of the problem at the present time as here stated, warrants them in making the recommendation that this Association adopt as a standard form of coupling the Janney type of coupler; that the Association procure one of the present makes of Janney type of coupler, selection being made by a committee appointed for that purpose, and then all other forms of couplers that will couple to and with this coupler under all conditions of service are to be considered as within the Janney type, and conforming to the standard of this Association. Your committee trust that you will see fit to submit this recommendation to letter ballot. We make it with a full appreciation of the gravity of the situation. We have, as our present and previous reports we trust will show, approached this conclusion with great consideration, and we believe that no other conclusion would be in harmony with the facts.

Our study has been based purely on the mechanical features of the problem, although we have not hesitated to consider and point out incidental advantages, not mechanical, that would result from the adoption of the Janney type. We believe that the office of this Association and of its members is with the mechanical department of railroading, and that what our railroads want and look to us for, is a statement of what type of coupler best fulfills the mechanical condition of a perfect train connection. When we have done this we have performed our duty, and to our superior officers belongs the question of negotiation for the use of the couplers. If you approve the recommendation of your committee, you give the railroads the type of coupler which meets more of the requisites than any other type or form; it is a type capable of fundamental duplications, already duplicated successfully, so that there is now, and we believe there will be still more, opportunity for selection between several different forms of the same type.

There is an urgent necessity that the Association should act at this time, either in the line that your committee has recommended or in some other. Railroads have reached a point where there is an absolute need for an automatic train coupler; it is vividly apparent that a coupler must be introduced to save the life and limb of the employé, decrease the cost of operation by enabling the use of power train brakes, to do away with the shocks of stopping and starting and to eliminate the damages of bunching trains in sags and hollows. The public demands it, the safety of the trainmen demands it and the economical operation of railroads demands it. Already several corporations are acting, and more, some of them very large, are getting ready to act this year; the urgency is great, and will not brook delay. If we do not agree upon some course we shall be reprehensible, for it is only by this Association that uniformity can be established so that all of the lives and limbs which it is possible to save, will be saved; that all of the benefits in operation that it is possible to achieve, will be achieved. If we do not secure this uniformity, who will be responsible for the extra risk which comes to trainmen when two odd couplers on a home and foreign car are brought in conjunction? Who will be responsible for the extra cost of operation that such a condition will entail? This Association. The fruit is now ripe, and if you do not pick it, it will be spoiled for next year. Numberless complications arising from the introduction of miscellaneous couplers will leave this Association in a mess from which we shall never be able to rise, and our opportunity to serve our fellow men and our companies will be irrevocably lost.

In view of the facts already mentioned, that the best type of coupler is undergoing development in matters of strength and simplicity, and that many railroads are not ready to adopt it until it is better perfected, your committee would further recommend the continuance of the use of the Marks, Ames and McKeen couplers as the best representatives of the loose coupler. (Signed.)

B. K. VERBRYCK,
JNO. W. CLOUD,
E. W. GRIEVES,
JOHN KIRBY,
F. D. ADAMS,
R. C. BLACKALL,
JOHN S. LENTZ,
E. B. WALL,
} Executive Committee.

The convention then adjourned till Wednesday morning, when the report on couplers will be discussed.

In the afternoon many of the members and visitors present visited the falls of Minnehaha, Fort Snelling, the great Pillsbury flour mills and other objects of interest in the vicinity. One party visited the Northern Pacific car shops, situated on their line between Minneapolis and St. Paul. The shops are intended for passenger cars only, are well built and laid out, and well equipped with machinery, tools and other appliances for building and repairing cars. Three varieties of lathes for turning steel-tired car wheels were at work and excited general interest. A machine made in Minneapolis and intended for grinding chilled wheels was especially noticed. The paint shop is fitted throughout with a system of speaking tubes, which are found to give good results and are applied in a somewhat novel manner. A portable slide, capable of being lifted out of the way, is used for conveying chips and refuse from the car shops to the furnaces of the boilers which supply the shops with steam. The shops are built of light cream-colored brick and were found admirably clean and in good order. The visitors then inspected two Pullman sleeping cars fitted with the improved heating device manufactured by the Safety Car-heating & Lighting Co. This device has been already illustrated in our columns.*

The method of testing brakes on trains before starting on their long trans-continental journey of over 2,000 miles was then inspected. The trains run through solid, and it is therefore important that the whole brake and rigging should be carefully tested on special sidings before the cars are tested as usual when the engine is first attached to the train. The grades attain a maximum of nearly 300 ft. per mile on the switch-back over which the traffic is worked while the Cascade tunnel is being constructed. This tunnel when finished will be nearly two miles long. Mr. Oakes' private car, which was built at the shops in 62 days, was then inspected, and the visitors returned by rail to Minneapolis.

WEDNESDAY.

The convention met at 10 a. m. on Wednesday, and proceeded to consider the rules of interchange, seriatim. Mr. Rhodes asked if the various railroad clubs had not suggested changes. The Secretary replied that such suggestions would be read with the rule to which they referred. A letter from Mr. J. W. Marden (Fitchburg) stated that safety appliances were often in bad order. He had placed 300 running boards and grab irons on foreign cars in one month at North Adams.

The following changes were then made in the rules:

Rule 3, section B: the flat vertical surface on flange altered from 7/8 in. to 1 in. on motion of Mr. Mackenzie; a change accordingly to be made in defect gauge in clause G and the 5/8 in. root of flange changed to 1 1/16 in. Clause K altered to read that wheels will be rejected which measure more than 4 ft. 5 3/4 in. between flanges. Mr. Rhodes moved an addition to the rules so that wheels would be rejected for longitudinal seams on tread 3 in. long or more. Carried. Mr. Cloud moved an addition to Rule 4 providing that cars which are unsafe to trainmen may be refused. Carried. Rule 5: size of defect card altered to 3 1/2 × 8 in. Rule 7: on motion of Mr. Packard (New York Central) the words "and owners notified before repairs are made" were added. Rule 14 was altered in accordance with previous resolutions. Rules 20 and 21 were altered to read "from the company on whose lines the bodies, etc., were destroyed." This is to meet cases where cars are destroyed by freshets, riots, fires and other causes originating outside the railroad. After considerable discussion a committee consisting of Messrs. W. Forsyth, Jos. Wood, J. N. Lauder, R. D. Wade and R. S. Blackall was appointed to report upon the settlement prices for new cars. Rule 22: The committee recommended that the prices for bodies and trucks be stated separately, as follows: 8-wheeled box or stock car bodies, 32 ft. long and over, $275; under 32 ft., $240. Gondolas, drop bottom, 20 tons or over, $220; 15 tons or over, $180. Gondolas, hopper bottom, 25 tons or over, $275; 20 tons or over, $240; 15 tons or over, $200. Gondola, plain, 32 ft. or over, $150; under 32 ft., $125. Platform cars, plain, 32 ft. or over, $125; under 32 ft., $100. Trucks, wooden transoms, $200; iron transoms, $250. Four-wheel ordinary coal cars, complete, $200. Four-wheel box car, complete, $230. Four-wheel drop-bottom gondola, $300. All these recommendations were adopted. Rule 23: An additional paragraph was moved by Mr. Packard that the number, line and class of car be stenciled or painted on the trucks returned. Carried. Rule 25: Price of cast steel or steel castings altered from 9 cents to 8c. per lb. Spring steel 4c. per lb., with a credit of 3/4c. per lb. Rule 26: Mr. Miller moved that the word leased be struck out. Carried.

Some changes were made in Rule 29 providing that any question as to the construction of these rules be referred to a committee of arbitration, composed of three representative members appointed annually by the Executive Committee. Mr. Cloud moved that a change be made in the wheel defect gauge, but the motion was lost. It was agreed that the discussion on the rules of interchange should not be published in the annual report and that the rules themselves should be printed in a concise form. Mr. Whitney, on behalf of the wheel-makers, suggested that a joint conference of master car-builders, master mechanics and wheel-makers be appointed to consider the guarantee of mileage and the defects of wheels, and ascertain the opinions of practical men on both sides. This was agreed to, and the President of the association will nominate three members to confer with committee of the Wheel-makers.

The Convention then proceeded to discuss

THE COUPLER QUESTION.

Mr. Cloud moved that the final report of the Executive Committee on Car-Couplers be adopted and the Committee instructed to carry its recommendations into effect. Mr. Rhodes strongly supported the motion. Many had been surprised at shocks with Janney couplers at Burlington, but it would have been greater with loose slack, and less if the train had been solid with no slack whatever. The shocks with the Eames train fitted with vertical plane couplers that had slack were considerable and were somewhat diminished by wedges taking out the slack. Careful experiments on a large scale on the Chicago, Burlington & Quincy showed that there was less difficulty in starting a train with spring slack only. The object and benefit of close coupling is felt in working over sags and in starting, not in braking. Already tons of wedges are used on the fast freight trains on the Chicago, Burlington & Quincy, the superintendents and men both finding them highly advantageous. Close coupling is essential in passenger service. Vertical plane couplers are not yet perfect, but why should we wait till they are? We have the right type of coupler, and it should be submitted to letter ballot.

Mr. Robert Miller believed that the recommendation at Saratoga was correct. He did not, however, believe the Janney type had done any better than the Titus & Bossinger and the Cowell in endurance tests.

A letter from G. C. Watrous (Detroit, Lansing & Northern), saying that only 7 out of 26 Cowells had failed during one year's test, was read by the Secretary.

Mr. L. S. Coffin, Railroad Commissioner of Iowa, looked only at the question of safety of trainmen; he cared not what coupler was adopted provided only it was safe. The report of your committee, said he, was to me highly satisfactory; it betokens a better day for the hundred thousand trainmen of this country. The utterance of this Convention would have great influence in stopping the terrible consequences of the present imperfect couplers. During the next year the lives of one thousand trainmen will be sacrificed. If the Association did not act their responsibility for these lives would be terrible. The men had no power of appeal against the use of dangerous methods. He believed trainmen were no more reckless than other people, and, like other people, required protection from their own rash actions. Do not give them the chance to take the chances. There are safety couplers and continuous brakes that can be used on freight trains and save the men from being crushed between cars and falling off the roofs. The experiment on the C., B. & Q. proved conclusively that slack was entirely unnecessary. If the Association did act he would rouse the state of Iowa to pass legislation on the brake and coupler questions that would save the annual slaughter of 200 of her young men. If farmers had delayed in adopting improvements until the present string binder was brought out, we should still be using sickles. The Association should, like the farmers, adopt the best that was offered and so would reap the improvements of the future.

Mr. Coffin's eloquent speech was delivered with great feeling and earnestness, and was greeted with loud applause.

Mr. Cloud said that the difficulty was which of the many couplers ought to be selected. It was better to select a type than one coupler, and the selection of one type would not bind any railroad to adopt any particular coupler. The independent action of the states, without regard to the Master Car-Builders' Association, would increase rather than diminish the loss of life; the best interests of trainmen would be met by the general adoption of one type of coupler. Then every coupler, whatever its construction, would couple with every other coupler.

Mr. Coffin explained that he was opposed to state legislatures adopting any particular devices, and was in favor of legislation forcing railroads to adopt safety devices by a certain date on all their cars, but leaving the selection of the device to the technical officers, who were alone competent to undertake the task.

Mr. W. A. Stone, who was imperfectly heard, submitted an amendment to the effect that the Association be requested to consider the merits of the Cowell and the Miller types as well as those of the Janney type. The amendment was lost by a vote of 25 to 22.

Mr. Cloud's motion was then carried by a vote of 33 to 14.

The Convention then adjourned until Thursday morning.

THE EXHIBITS.

The following is a list of the appliances in connection with car building exhibited in the hall of the West Hotel. This spacious and remarkably handsome apartment affords an excellent opportunity to exhibit the different articles to the best advantage.

The National hollow brake beam shows a full-sized brake beam, which consists of a trussed tube. The Wagner car door in an improved form was exhibited by a model door. The Hutchins car roof is exhibited. The Scarret Furniture Co. exhibits several adjustable car chairs. Mr. M. N. Forney exhibits his well-known seat, and the section of the side of a car recessed for the elbow, a very sensible and comfortable arrangement. A model is exhibited of the Whitney contracting chill. Some samples of the Continuous straight fibre axles are exhibited. The Cleveland Forge Co. exhibited some of their well-known turnbuckles. The McKeen coupler is shown by full-sized draw-heads and by models. The Mississippi Glass Co. show several specimens of the embossed colored glass, which is very ornamental. This glass is largely used by the Manhattan and other roads. The Ross brake-shoe is shown by means of a shoe that has seen considerable service. Mr. Finlay shows a model of his 3-truck freight car. Specimens are shown of Damascus bronze car and engine brasses. The Thurmond car coupler is shown by full-size draw-heads and model cars running on a track on a reverse curve. The St. Paul Brass Works exhibits specimens of car and engine brasses made of Randolph's metallic compound. Stone's sash anti-rattler is shown applied to a full-sized window. The Barnes car coupler (which has been illustrated in the *Railroad Gazette*) was exhibited. The Electric Accumulator Co. of New York, exhibits a battery especially adapted for lighting trains by electricity. The Martin anti-fire car-heater is shown by blue prints, and has been already illustrated in these columns. The Wakefield Rattar Seat Co. exhibit two of their Henry patent tilting seats; one covered with rattan and the other in plush. The National Car Roofing Co. exhibit a model of their roof. The Improved Anchor Iron Car Roof is shown by a large model. The Vanbeck Reclining car seat was shown by two seats. The seat is inclined and the back can be set at any angle, and a comfortable movable foot-rest is provided. The reversing arrangement is simple. Adams & Westlake showed an improved reclining chair. Colburn's wood and paper brake-shoe was exhibited. The Stimson improved axle box was exhibited. A sample of Noyes' patent liquid cooler for mixing with other oils to prevent journals from heating was shown. The La Couir Manufacturing Co. exhibited their tropic fibrous waste. Corp's automatic car coupler was exhibited on a couple of model cars. This coupler is of the vertical hook type. The Hartford Woven Wire Mattress Co. exhibited car seats and mats. The Sewell car heater was exhibited. The Towne end door fastening is a very simple latch placed inside the car; when the door is pushed shut, the latch falls and prevents the door being opened except from the inside. This saves the necessity of placing locks on the end doors when carrying valuable merchandise. The device was shown by a full size door. Westbrook Cook showed models of no less than eight different kinds of automatic couplers of the Miller, Janney and other types. Also a wedge for taking up the slack in draw springs automatically. The Boston Coupler was shown on a couple of model cars. This coupler was used on the Eames train at the Burlington tests. The Dunham Co. exhibited a full-sized storm-proof door as applied to a freight car. This door has been previously illustrated in these

* May 13, 1887, page 315.

columns. Mr. Van Dorn exhibited a full sized draw-head of the Janney type. The locking-pin is actuated by gravity, but the peculiar feature of the coupler is a special arrangement for protecting the knuckle when coupled to an ordinary draw-head. A piece hinged to the draw-head opposite the knuckle fills up the space and protects the knuckle. The Hinson Automatic Coupler, a new device hailing from Des Moines, Ia., is exhibited by a full-sized draw-head. It is of the link and pin type; the link is controlled by the pin, and the pin is held by the dog. The link is maintained in a horizontal position by the weight of the pin. The Herrington coupler is of the Janney type and is shown by a full-sized drawhead. The knuckle is locked by gravity. The Cowell coupler is shown by several models. The Russell & Erwin Manufacturing Co. exhibited their diamond pointed steel screw nails. The Standard Car Heating and Ventilating Co. showed their improved car heating and ventilating devices, also a derailment brake and fire extinguisher.

The exhibition is remarkable for the number of couplers of the Janney type exhibited, and for its numerous improved seats. Wheels, usually a conspicuous feature, are entirely absent, none being exhibited. A notice of some further exhibits is deferred until our next issue.

Test Specimens.*

THE EFFECT OF SIZE AND SHAPE ON ULTIMATE STRENGTH, ELONGATION AND REDUCTION OF AREA.

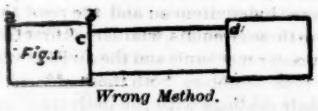
There are tricks in all trades, and in nothing is this proverb more significant than in the testing of the strength of materials. Given a certain piece of cast or wrought iron, or of steel for testing, any one of the three qualites of ultimate strength, percentage of elongation or reduction of area may be varied from 10 to 50 per cent., depending on the way the specimen is shaped up for the machine. In this paper tension tests alone will be considered, and the tests are supposed to be made on small specimens, less than two feet in length, and having an ultimate strength of less than 200,000 lbs. That is to say, the facts stated obtain with all *specimen tension tests.* These facts have been demonstrated experimentally, and may all be explained theoretically. They are therefore incontrovertible.

All modern testing-machines hold the specimen in friction grips, the test piece having plane flat or round ends. The end sections must be somewhat larger than the middle portion, or neck, of the specimen, to prevent breaking in the grips. There must always be, therefore, a reduced section in the middle portion of the piece. This is the section whose dimensions are taken, and on which rupture will occur. The "length" of the specimen is the length of this reduced section, and the percentage of elongation is computed from the stretch or elongation of this portion. The great differences in the results which may be obtained from the same original specimen depend entirely on the way in which this reduction is effected from the original piece. Brittle materials, such as cast-iron and hard steel, must have the grip ends carefully trued up in lathe or planer before testing, so that the grips will not tend to throw the piece out of line. With wrought iron and soft steel, which elongates considerably before rupture, this is not so important.

CAST-IRON AND HARD STEEL.

In the case of cast-iron and the harder grades of steel, the ultimate elongation and the reduction of area are so small as to be inappreciable, and are therefore not usually required in specimen tests. The main things are the ultimate strength, elastic limit, and modulus of elasticity. In commercial tests the last named is not usually required, and in cast iron there is no definite elastic limit, the ratio of the stretch to the stress in pounds per square inch being a constantly varying quantity. The main thing, therefore, in these materials is the ultimate strength. This is greatly affected by the form of reduction employed.

The Form of Shoulder.—If the reduction be made by a square shoulder, as in fig. 1, the strength developed will be

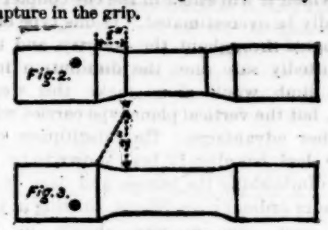


Wrong Method.

low. If the amount of the reduction is small, that is, if the reduced section is but little smaller than that of the ends, the weakening effect will also be small. But if the section is greatly reduced by a square shoulder, the weakening effect will be very great. The cause of this is evident. When the piece is under strain all the stress in the exterior fibres from *a* to *b* is suddenly concentrated at *c* and transmitted to the reduced section through the *external fibres* of this section at *c*. These fibres not being able to give, or to stretch out, as would occur with wrought iron, the piece begins to rupture at *c* before the internal fibres have been brought to their full strength. It thus tears apart much like a piece of cloth when pulled on one edge. With a deep square cut at *b*, therefore the material may be made to appear very weak, as compared to its true strength. Of course the rupture always occurs at the shoulder.

From the above it is evident that the only way to obtain a fair test with hard or brittle metals is to pass from the end to the middle section by very gentle slopes or by long curves, as shown in figs. 2 and 3.

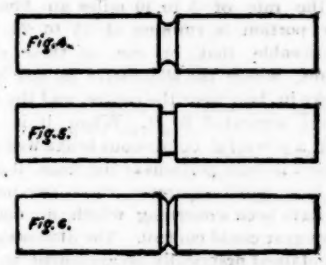
In any case the *amount* of the reduction should be small The area of the reduced section should be from 80 to 90 per cent. of the end areas. This holds for all materials. *The reduction should be as small as possible*, merely enough to prevent rupture in the grip.



Correct Methods.

For cast-iron and hard steel the length of the reduced section does not signify much. A length of one or two diameters is as good as more. The longer the reduced section however, the more it will represent the average of the material and the greater the chance of including a weak point, as a blow hole or particle of slag. It is well, therefore, to have the same rule for length in these materials as with wrought iron and mild steel, which is given below.

Effect of Length.—It is evident also from what has been said that the effect of a notch, or very short reduced section in cast-iron or hard steel, is to greatly weaken the test. Thus



Wrong Methods.

in figs. 4, 5 and 6, if the material is hard and brittle the effect is to give a very low tensile strength and would be a very unfair test of the material. With ductile materials, however, as wrought iron and soft steel the contrary effect will be found. That is, test pieces of the forms shown in figs. 4, 5 and 6 will show a very much greater strength than longer reduced sections of the same area. This is explained below.

WROUGHT IRON AND SOFT STEEL.

With these materials the commercial requirements are, ultimate strength, elastic limit, percentage of elongation, and of reduction of area. The material is ductile and will stretch from 10 to 30 per cent. of its original length before rupture occurs. It will also "draw down" or become very much reduced in size at the broken section. If the reduced section is long enough to admit of such action, and it is therefore not so likely to break at the shoulder. The form of the specimen at the shoulder is therefore of less consequence than with harder metals, but the length of the reduced section now becomes the ruling element in the test. It is best, however, to reduce gradually, as shown in figs. 2 and 3, in all cases.

The Effect of Length.—If the reduced section be very short, as shown in figs. 4, 5 and 6, the fibres here are supported or reinforced by the outer fibres in the end sections, and will not therefore stretch or pull out so freely as they would on a longer section. Now, the strength of the specimen at rupture is the strength of the section after it has been greatly reduced by stretching out, and if this stretch and consequent reduction is prevented by the small section being very short, it is evident that the ultimate strength will be greatly increased. Here the ductility of the material allows the outer fibres of the small section to stretch enough to bring the inner fibres under their maximum strain, and so the *full strength* of the *full section* is developed.

In the case of hard and non ductile metals, the full strength of this section could not be developed, on account of the sudden reduction. We therefore can see how a short reduced section, as in figs. 4, 5 and 6, would give too weak a test in brittle metals, and too strong a test in ductile metals If a wrought iron or mild steel rod breaks in practice, its ultimate strength is the strength of the section when that ultimate strength is developed, which section is always very much less than the original section. The test specimen should therefore be long enough to enable it to draw down freely under strain. This requires a minimum length of the reduced section of two or three diameters. So far as ultimate strength is concerned, this length would be sufficient to give a fair test.

The percentage of elongation is the total elongation, measured after rupture, divided by the original length. *If the specimen elongated uniformly this ratio would be a constant for all lengths.* Unfortunately the specimen always stretches or draws down more in one place, where the rupture finally occurs, than it does in others. The length of this greatly drawn down portion is usually two or three times the diameter of the specimen. To obtain uniform or comparable results, therefore, the length of the reduced section should always be made a certain number of diameters. It has been customary to specify a certain absolute length of reduced sizes, as 8 in. for all sizes from which to compute the elongation. This is evidently erroneous. Thus a specimen 2 in. in diameter and 8 in. long on its reduced section has a length of only four diameters, while a specimen ¾ in. in diameter and 8 in. long has a length of nearly 11 diameters. Now since a large part of the elongation occurs within 1 diameter of the broken section, or say in a length of 2 diameters, this part of the elongation has been divided in the one case by a length of 4 diameters, and in the other by 11 diameters, and hence the percentage of elongation will be very much greater in the former case than in the latter, the material and length of specimens being the same. The specification should require a length of say *eight diameters*, instead of *eight inches*, and then the percentages of elongation will depend only on the material, and not on the diameter of the specimen, as it now does. This will be clear from a study of fig. 7, which shows a great reduction at the broken section, such as always occurs with ductile materials.

Thus the entire reduced length is somewhat reduced in size, as shown by the dotted lines, but near the ruptured section, from *a* to *b*, fig. 7, the reduction is excessive. If, now, the original length had been only the portion *a b*, the elongation might have been over 30 per cent., whereas, if a length of eight diameters had been used, perhaps not over 20 per cent. would have been obtained. If, therefore, an elongation of 25 per cent. in an 8 inch specimen is required, the manufacturer has but to choose a sufficiently large specimen in order to obtain it, whereas, if it were specified an elongation of 25 per cent. on a length of 8 diameters, the material might not show an elongation of over 18 or 20 per cent.

If no length of test piece is specified, then the manufacturer may choose a length of about 1½ or 2 diameters, and obtain an elongation of 30 or 40 per cent. from material which, on a length of 8 diameters, would not show an elongation of more than half as much. The writer does not remember having seen more than one set of specifications in which the length of test piece was required to be so many diameters. So far as *reduction of area* is concerned, a length of two or three diameters is sufficient to give a fair test. If the reduced section is shorter than this, the reduction will be too small.

The proper elongation and reduction to be observed is the elongation and reduction *at the time of maximum load.* After the piece begins to draw down in one point, the strength decreases so that if the beam of the testing machine is kept balanced the poise must be run backwards, until rupture occurs. Evidently if the load was suspended from the specimen as a weight the piece would pull out and rupture as soon as the maximum load was put on, and so far as giving any warning of failure is concerned the ultimate elongation and reduction would be these at the time of maximum loading. These could also be rapidly observed in making a test. Thus when the poise must begin to be moved backward to balance the beam as the piece is pulled out, then stop the movement and measure the elongation and reduction. The custom has become universal, however, to measure these after rupture, so values taken as above would be misunderstood and would not be comparable with those taken after rupture. So far as indicating the ductility of the material is concerned, the common method is good, but it must be understood that as a warning to indicate coming failure these values as obtained from a breaking test are always too large.

THE GOVERNMENT SPECIFICATIONS FOR BOILER IRON.

In the government specification for marine boiler iron the form of the test piece specified is that shown in fig. 8.

Holes are drilled in the plate, about one inch in diameter, and then it is sheared through these holes, leaving a specimen of the form shown. Now, from a test on this specimen the percentage of elongation and reduction must be obtained. The common practice is to take the measure of the distances *a b* and *c d*, and also the thickness of the plate on *c d* before and after the test. Then the increase in the length of *ab* divided by the original length of *ab* is the percentage of elongation, the reduction of area being taken on the broken section *cd*. Now such results can evidently only be compared with others obtained in a similar manner. Neither the elongation nor the reduction are such as would be obtained on a specimen having a *uniform* cross section for a length of eight diameters. For instance, to what length shall the stretch be credited? Most of it certainly occurs on the middle portion of the length *a b*, but on this portion the stretch is abnormally large, since it is immediately adjacent to the section of rupture. These two errors are in opposite directions, but they do not exactly compensate. The same is true of the reduction. The length is too short to allow of a normal drawing down of the material, and hence the reduction is less than would be obtained from a longer reduced section. The method is therefore wholly irrational and has but one thing to recommend it; that is, the ease with which specimens can be prepared. There is great difficulty in shaping out boiler plate test pieces to the forms shown in figs. 2 and 3. If a dozen or so are to be prepared at once they may be set up together and cut out on a planer or jumper, but for one or two piece this is impracticable. The writer would be glad to know whether or not a machine is in the market that is adapted to doing this kind of work.

CONCLUSIONS.

1. The gripped ends must be symmetrical with reference to the reduced section and have true surfaces.

2. The reduction of the tested section should be not more than ten per cent. of the end areas.

3. This reduction should be made by low slopes or curves of large radius, as shown in figs. 2 and 3.

4. The length of the reduced or tested section should be eight diameters in all cases.

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RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes! etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The Inter-state Commerce Commissioners have issued a long and important document, an abstract of which comes as we go to press. The Commission again declines to decide in advance what constitutes discrimination, but leaves to the carrier the responsibility of interpreting the law. But the Commission points out the conclusions to which it has come on the questions already raised, and indicates plainly that competition, under certain circumstances, produces conditions so dissimilar as to justify charging more for the short than for the long haul; but also that the railroads are not to take upon themselves the building up of special industries or business centres.

In the discussion upon Mr. Brown's paper on the Canadian locomotives, some points regarding the cost of building were not made clear. It should be noted that Mr. Brown had to pay four cents a pound for cylinder castings, while Mr. Johnson's cylinder castings probably cost him less than two cents. The same is true of driving-wheel centres. It will probably be found that, allowing for freight and duties, the Canadian locomotives were built quite as cheaply as they could have been built in England. On the other hand, were the English-built locomotives imported to Canada, they would have to pay at least $2,000 a locomotive in duties.

The great wheat "corner" in Chicago, which began some months ago, seems to have broken. It is to be hoped that the manipulators have got a lesson that will last them a little while,—long, one cannot say in reason. The beginning of the harvest was pretty sure to bring this solution of the difficulty. While the "Napoleons of Finance," and the Cæsars of Pork, in Cincinnati and Chicago, could corner wheat for a few weeks, at the end of the season, their only hope was to clean up and get out before the avalanche began to move from the southerly fields where the harvest has begun. One interesting aspect of the situation lately has been the effort in Chicago to attribute the blockade to the railroads, and to saddle upon them the responsibility of furnishing storage for the wheat brought. It was proposed to take measures through the State Railroad and Warehouse Commission to compel the roads to furnish "terminal facilities" for all the grain they accepted. The railroads have their own cussedness, and enough of it to answer for; and it *is* rather hard to block their lines with loaded wheat cars and then blame them for not moving.

CAR COUPLER DECISION.

The Master Car-Builders' Convention at Minneapolis, now practically concluded, seems likely to be memorable for an important decision on a very knotty problem. The Executive Committee, to whose charge the car coupler question has been intrusted, have at last made a report, which has been adopted by the convention by a majority of 33 to 14. If this report is sustained by letter ballot, the importance of the change which it will effect in the car coupler question can hardly be overestimated. If one type of coupler were adopted throughout the country, and that type an admittedly safe one, the diminution in loss of life and limb would alone make this step one of progress, but the vertical plane type carries with it also many other advantages. The substitution of spring for loose slack has already been shown to be of great value in diminishing the bumps and jars in braking trains under ordinary conditions, shifting in yards and running over sags as was shown in the discussion on the adoption of the report of the executive committee. The severe shocks experienced at the Burlington brake trials with the Janney coupler were really incapable of being materially modified by any form of coupler, as was aptly argued. We know that ordinary causes produce shocks with loose slack, and extraordinary causes will produce it with spring slack, and under these extraordinary circumstances it seems doubtful whether making the train one solid body would altogether obviate the results produced by the front portion of a train traveling at the rate of 5 to 10 miles an hour, while the rear portion is running at 15 to 20. It was very noticeable that in one of these shocks at Burlington, where the slidometer moved 70 in., the train broke in two near the centre, and the two portions were separated 60 ft. When it is borne in mind that a powerful continuous brake was on nearly every wheel in both portions of the train, it is evident that the force which separated these two portions 60 ft. must have been something which no coupler and no buffing gear could control. The discussion on the report contained practically no argument in favor of the link and pin system. Those who spoke against the report confined their remarks to asserting that the Cowell or Miller type, or the Titus and Bossinger type, were at least equal if not superior to the Janney in point of durability and freedom from breakage.

It is a somewhat remarkable sign of the progress made in this question, that at a Master Car-Builders' convention in a debate on the propriety of adopting a final report on the car coupler question, the debate should wholly turn upon the relative merits of the three different types of vertical plane couplers. It is not an unjust inference to suppose that the question of vertical plane *versus* link and pin is, in the opinion of the car-builders of the country, practically no longer in dispute. The committee by the last clause of their report recognize the extensive use of three of the best forms of link coupler and the considerable improvement that these present over the ordinary link and pin couplers, and do not ask that the use of these improved couplers should be abandoned until what they believe to be a still better type has conclusively proved its superiority. This was possibly the only course open to prudent men.

If the report of the Committee is sustained by letter ballot, and the railroads of the country agree that it is desirable that all couplers used on freight cars shall be the Janney type, and couple automatically under all conditions of working with a standard Janney coupler, the position is much like that of the railroads in regard to the gauge question. It is pretty generally recognized that mechanically a four foot eight and a half gauge is not the best, and that were we to start railroads afresh, or in a new continent, a somewhat wider gauge would be chosen. It is much the same with the coupler question. It is generally recognized that the Janney coupler is somewhat too weak, but its dimensions have become standard, and we must make the best of it within those dimensions, exactly as a locomotive designer has to make the best locomotive he can for a standard gauge, although he knows that he could make a better one were the gauge slightly wider. It is a hopeful sign that this difficulty, much felt several years ago, is little noticed at the present time, and in fact the most powerful Consolidation engine (the Kitchigami) ever built by the Baldwin Locomotive Works, is running on a gauge several inches narrower than the standard. It is to be hoped that experience, improved material and improved methods of construction will give the same results with car couplers, and that within the limits permissible, master car-builders and manufacturers will be able to produce a coupler sufficiently strong to meet all the requirements of actual service.

The Committee refer to three directions in which greater strength might be gained, as the dimensions cannot be increased: either improved material must be used, or the coupler must be relieved of buffing strains. It should be borne in mind that as used in passenger service the latter alternative is adopted with both the Miller and Janney couplers. When the Janney coupler was introduced for freight service the buffer was omitted, apparently with an idea to cheapen and simplify the coupler. This has proved a mistake. Buffers are even more required in freight than in passenger service, and it is to be hoped that at the earliest possible date some road will make practical experiments with different forms of buffers in combination with vertical plane couplers, and will ascertain what strength and range of buffer spring is best suited for freight service.

In this world of compromise we have often to choose the least of two or more evils. This has been the case in the decision that the Master Car-Builders' Convention have arrived at on the coupler question. The only course is now to endeavor to remedy that defect, and it is to be hoped that all railroads will sink personal and local predilections in favor of one or another type of couplers or particular coupler, and will unite in an endeavor to use and improve couplers that will couple automatically with one another.

Road Foremen of Engines.

Locomotive engineers, or enginemen, as they are called in deference to the feeling among civil, uncivil and other engineers, that the strictly scientific term tends to give to uneducated men too much professional standing, have always been regarded as constituting the most important branch of the *personnel* of a railroad, and this view is in many respects a correct one. The engine runner does not have to study the fine points of human nature involved in the perfecting one's self in the art of dealing with men, which passenger train and station men have to take an interest in; but the intelligent care of his engine and the economical handling of his train afford ample scope for a high order of mind, even when we omit all consideration of the important moral issues involved in the large responsibilities for life and property which rest on most of the men of this class. It is, therefore, well that the supervision of these men occupies, as it does, a large share of the thought of those whose duty it is to look after the discipline and welfare of the employés of a railroad.

The rapid growth of railroad systems in this country has however kept the discipline of the men in this as well as other departments in an unsettled state. On a great many roads, periods of stagnation, when no reform, however slight, was entered upon lest it cost a few dollars, have alternated with seasons of expansion, when every effort had to be given in the line of keeping pace with the simple necessities of the situation, without a thought of the systematizing necessary to place an administration on a footing where it can cope with all degrees and phases of activity. But this state of things is gradually giving way to a better one. Experience is leading (and driving) managers to a study of more efficient methods. Master mechanics who have regarded runners as simply machinists find that good service necessitates a co-operation, in the selection and discipline of men, between themselves and the division superintendents; the latter are learning that this co-operation is necessary to the best results even from their own side of the view; and higher officers see that this co-operation demands their encouragement and direction. These reflections are suggested just at this time by the circulars of the Philadelphia & Reading road, published in a recent issue of the *Railroad Gazette*, which serve to give point to matters that on many roads are left in vague indefiniteness; and the *road foreman*, referred to in these circulars, who acts as first lieutenant of both the master mechanic and the division superintendent and thus combines both those officers in one, as regards their dealings with the individual enginemen, is the most important and interesting figure brought out in the presentation of the matter.

This office needs to combine a great variety of qualifications, and is not easy to fill. A first class machinist and mechanic, who has perfected himself by long years of application, may have been during the same time killing out what little natural aptitude he had for dealing with men and effectively superintending them; knowing how to do a thing and knowing how to get others to do it are in many respects two different arts. Ability to economize fuel, to make steam under difficulties, and to skillfully disentangle himself in emergencies may be taken for granted, as this line of qualifications has always been had in view by those who have created this office, and the master mechanic, who has the first voice in selecting the man, naturally considers these points first; but others, which involve different mental qualities, are not so easily settled. The acquiring of correct habits in the matter of carrying out train rules and co-operating with conductors to the best advantage, which, as well as the other things named, the road foreman must him-

self know before he can teach them to others, are more naturally looked after by the superintendent. It may, therefore, frequently require considerable conference and inquiry on the part of these two superiors to pick out for promotion a runner combining these two principal classes of qualifications; and then, if they succeed, the most serious difficulty of all may still be left, in the fact that the man has no aptitude for teaching others. In time a class of men with the right mental equipment, might with proper care be raised up, though the ability or tact to deal kindly, firmly and intelligently with subordinates is a trait that is the hardest to diagnose in the untried candidate, and one whose existence is very generally regarded as proven only after the actual demonstration of experience. Preliminary training, or at least a degree of self-preparation, is certainly necessary, and to provide proper men for the present necessities that exist on most roads the best that can be done is to carefully canvass the force of runners for those of proper age who possess the largest natural ability in maintaining harmonious relations, while still enforcing strict orders; who will be most likely to have skill in wearing a velvet glove on an iron hand. The propriety of considering the age of candidates is referred to because the taking of the man who at the present moment is the best qualified is far from being in the interest of true economy if he be too old to learn, or to broaden his mind by experience; at least he is not the one for the place unless a younger associate or lieutenant be put in training to step into the elder's shoes.

As a permanent policy, the selection of the right kind of young men who shall, during an extended course in lower departments, be in more or less active training for the specific higher position, as is done by the Pennsylvania road and its imitators, is undoubtedly the best thing; and if all the young runners can be of this kind of material so much the better. A practical application of the industrial education idea can be put in effect without any extensive endowment of bonds or real estate, and without very great effort, if young and ambitious runners are given to understand what is wanted of them, and are accorded some slight material encouragement to start in the race. Most roads can also learn a valuable lesson from the Pennsylvania administration in its practice of having lieutenants nearly or quite as well qualified as the principal, constantly in training, not only in such lower grades as are generally counted educational and preparatory, but in the higher working positions as well. So perfect a system as the Pennsylvania's could not be maintained if the staff were kept down to the lowest possible working limit.

To detail the duties of a road foreman would fill a volume, and then not exhaust the subject. After mastering the Catechism of the Locomotive and studying a stenographic report of the several weeks' solid work done by the Convention Committee on Train Rules, as preliminaries and as crystallizers of whatever may have been vague in previous experience, the aspirant might begin on realities by marking out a plan for examining the runners to find out what they know, and a policy to be followed in the important matter of detecting derelictions. It is now recognized by progressive managers that the most sensible and economical way to sound the depth of trainmen's knowledge of their business is to skillfully question them in a systematic manner, rather than depend upon the slow-but-sure process of waiting for surface indications in the service performed. Among, say a hundred runners, the average standard of ability will indeed be apparent from observable results, though the good features will, in the nature of things, be much less noticeable than the opposite kind, and have to be largely deduced by contrasting from the latter; and even then the qualifications or deserts of individual men will remain, to a large degree, unknown. Actions speak louuer than words, and we do not deny it, but words have their place, nevertheless. One advantage of the latter, which ought to be appreciated by superintendents, is the facility with which they can be canvassed in the office, instead of necessitating a multitude of outdoor journeys. To *see* what your runners are doing is an arduous as well as a delicate task; to *ask them about it* is enough easier to warrant managers in taking all possible means toward making the asking process reliable and easily applicable.

This catechising of men, which is now systematically practiced with both enginemen and conductors on the best roads (so far as new appointments are concerned) is regarded by many as important enough to demand more than a single mind; a board of four or five, as on the Baltimore & Ohio, being deemed of value and not too large; but the road foreman should, for his department, be qualified to act as the head of this board. No officer is too high for service upon it, and the more experienced and able the average of its membership may be, the better; but the intercourse with the enginemen will be more free and satisfactory in proportion to the nearness to themselves that they can discern in the examiner. The road foreman, then who can retain his sympathy with his late brethren, and thus be in a position to disarm their prejudices and put them at their ease, and who can, at the same time, make use, either through what he has learned himself or in the way of counsel judiciously drawn out in the workings of an examining board, of the experience and wider knowledge of his superintendent and other superiors, is the ideal man for his place.

The detection of carelessness or neglect, or, to word it differently, the seeing that what should be done is done, is a wide field. Its importance is real, the same as that of the split key that holds the nut that holds the bolt that keeps in place a vital member of a great machine, and yet it must not be obtrusive or develop too much friction in working. Some of the most important points in the discipline of a body of men are best enforced when an individual has violated that discipline and his behavior is used as a text or object lesson, and yet some of the most instructive of such object lessons will never be brought to light without some such officer as a "spotter." This is an odious term, made so largely by the railroads themselves; but the principle of taking men unawares so that they shall not have two standards of fidelity, one for the master's eye and another for ordinary times, is not wrong and can be employed so that reasonable men will not rebel at it. It is recognized and used in the training of city fire departments when there is no fire, in the inspections of military service and in other ways, and by the railroads themselves in the auditing of agents' cash accounts. Superintendents acknowledge that it is necessary in the case of rear-end brakemen; it is similarly useful in other departments. The question asked by a correspondent a few weeks ago, whether it is worth while to bother runners with such espionage as will detect their careless or willful negligence (or worse fault), is answered according to what kind of a man conducts the business and the spirit in which he acts. The lesson from the experience in the lines just cited is that if the delicate business of "nosing around," picking flaws, or whatever name it is called by, is expected by the men as a matter of course, is always done honorably and above board, and by men in whose high-mindedness and honor general confidence can be placed, successful results will be achieved. The first step is to have a full and deliberate understanding with the men, so that they shall fully understand that the action taken is necessary, without regard to the general standard of honesty or skill among the force, and that their honor is not in the least impugned. The object in unexpectedly showing "danger" at a signal which usually shows safety is to sharpen the wits of those enginemen who are liable to become forgetful; not to "trip up" those who *design* to pass that point without looking, because they judge it to be unnecessary. The road can afford to assume that it has no men of the latter kind; if there are any, they must take the consequences.

Tire Fastenings.

The necessity of a safe tire fastening is forcibly brought to mind by the too frequent breakage of steel tires under passenger equipment. These tires are made with a central rib, drilled for a bolt hole, and in each case the fracture goes through the bolt hole. When this happens there is of course nothing left to hold the wheel to the centre, and the day cannot be far distant when some disastrous accident will happen to a passenger train from a broken tire leaving the wheel and derailing the train. It is quite possible to altogether avoid such an accident. Great care and watchfulness will nearly, but not quite, prevent the breakage of steel tires under passenger cars, and, therefore, perfect safety can only be secured by some device which will render a broken tire harmless. It is evident that as long as the tire remains firmly in place on the wheel it can do no mischeif, even if completely broken across in several places. The breaks then become virtual cracks and nothing more.

The Mansell fastening provides this safeguard and has abundantly shown itself capable of holding a broken tire firmly to the body of the wheel. Years of experience with over 100,000 wheels fastened on this plan have fully demonstrated this point. On the other hand, it has been long known that steel is much weakened or nicked by holes drilled in it where it is exposed to tension. Civil engineers have long discontinued drilling or nicking the lower flange of steel rails because that flange is in tension and a hole in it means virtually starting a crack which will soon spread and sever the rail. Why then do mechanical engineers still drill holes in the tension member of a steel tire? The answer will probably be that the rib on a tire is not a tension member. A little consideration will show that when a tire is weighted it tends to flatten just above the rail, as shown on the accompanying diagram.

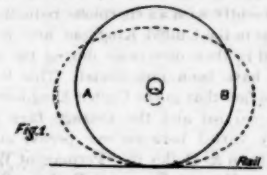

Fig. 1.

If the solid lines represent the form of the tire unloaded, the dotted lines show on an exaggerated scale the form that the tire will assume when loaded. It is evident that over the point where the tire rests on the rail the inner part of the tire will be stretched or in tension, and that at the points *A* and *B* the inside of the tire will be in compression and the outer part in tension. The result is that the inner rib on a tire is constantly alternately compressed and stretched at every revolution of the wheel, and that a bolt hole just at this point is a serious source of weakness and quite sufficient to account for the breakage of an otherwise strong tire. With the Mansel fastening, no internal rib is necessary, and there are no bolt holes through the tire, and consequently no weak spots at which a fracture can commence. With a ribbed tire on the other hand the weak point is obvious.

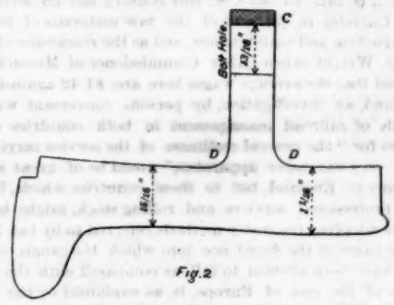

Fig. 2.

The accompanying section shows a tire that broke recently under a sleeping car. It will be seen that when the tire was in tension only the metal at *C*, where it is cross sectioned, remained as the tension member of the tire considered as a girder.* When once this had cracked through the tension member, the internal rib was practically "nicked" at this point, and the crack spread downward till it reached *D D*. The great increase of section of metal below would prevent the crack extending were not the oil always present on wheels, ready to assist in widening and deepening any crack once begun. As the crack is opened infinitesemally at every revolution of the wheel, the particle of oil seizes its opportunity, wedges itself forward into the breach, and never lets go until the tire is broken.

This is a typical case, one of many in which a fine material has come to grief through faulty design. The remedy and the moral are alike obvious. Steel should not be nicked, especially close to the edge of a tension member, and tires should be secured by fastenings which require no holes drilled in the tire.

English Railroads and Canals.

The very high freight rates on English roads turn the attention of the public to the cheaper transportation thought possible by canals, as necessary to the retention of their manufacturing and commercial position. The London *Times* in an article on this subject says: "The cost of internal carriage, though not producing any excessive remuneration for share holders, presses with stifling weight upon industry. Our application of science and capital has yielded the grotesque result that foreigners at a great distance can beat our own producers out of the home market merely because they send their goods by sea, while the home producer has to send his by rail. * * * The fact remains that this country with high rates of internal transport is at a great disadvantage in competing with other countries where the rates are low. The regulation of railway rates may do something to remove grievous anomalies, but the only real remedy for the general costliness of a service carried out with very expensive apparatus is to develop and extend the less expensive modes of communication which railways have thrown into the background."

In the absence of any returns, by English roads, of the cost or the amount by ton miles of their traffic it is impossible to state the expensiveness of this internal traffic, which presses with stifling weight upon industry. Mr. Jeans, in his Railway Problems, p. 320, puts it at 1¼d., which is just three times the amount charged on the principal Ameri

* It is small enough in section in the view shown, but in some cases it measures far less, being only 3-32 in. thick in one case, the cross section being only .03 sq. in.

can lines, as already ascertained, and on p. 251, 1¼ to 1⅝d. *Engineering* thinks it is certainly more than 1d., and Mr. Dorsey in his papers read before the American Society of Civil Engineers, "English and American Railroads Compared," assumes 2 cents as a minimum. Mr. Jeans, Railway Problems, p. 56, says in comparing the roads of the two countries as investments, "The railways of the United States have effected this increase of 468 per cent. in their net receipts, concurrently with an enormous reduction in rates and fares, whereas in the United Kingdom any reductions that have occurred in these directions during the same interval (since 1871) have been immaterial. This is substantially proved by the fact that in the United Kingdom the average rate per ton carried and the average fare per passenger have scarcely varied between one period and the other.

Messrs. Colburn & Holley in "Permanent Way and Coal-Burning Locomotives of European Railways" thought that in 1855 and '56 the rate was 2¾ cents, and Mr. Conder says in the Report of the Select Committee of the House of Parliament on Canals, 1883, that the rate is 1.08d., adding "50 years after the opening of the Liverpool & Manchester Railway it costs more to convey a bale of cotton from one city to the other than it did in 1829." This cost, according to Sir Bernard Samuelson's report to the President of the Association of the Chambers of Commerce of the United Kingdom, is $5\frac{8}{10}$ cents per ton mile.

In this country, as returned in Poor's Manual, the figures have been as below:

June.	Ton mileage.	Freight earnings.	Charge per ton mile, cents.
1883.....	44,064,923,445	$549,756,695	1.236
1884.....	44,725,207,677	502,869,911	1.124
1885.....	49,151,894,469	519,690,992	1.056

Our freight transportation is, then, the cheapest in the world, as England's is about, if not quite, the dearest.

As it is safe to say that this country has no advantage over England in the cost of the raw materials of railroad construction and maintenance, and as the researches of Carroll D. Wright when Labor Commissioner of Massachusetts showed that the average wages here are $1.42 against $1 in England, an investigation, by persons conversant with the details of railroad management in both countries of the causes for "the general costliness of the service carried out with very expensive apparatus," would be of great service not only to England, but to those countries which, buying both professional services and rolling stock, might hesitate before adopting the costly methods referred to by the *Times*.

The cause of the decadence into which the canals of England have been allowed to fall, as compared with the waterways of the rest of Europe, is, as explained by the *Times*, "The rapid growth of the railways, combined with the start which enabled English manufacturers practically to demand their own prices in the foreign market, threw canals entirely out of the general movement. Generally speaking, they are to-day what they were fifty years ago, and, as a consequence, are inadequate to cope with modern demands." Now, through the competition engendered by the less general costliness of the service carried out by other nations, England's manufacturers confront not only the falling prices consequent on an increased supply, but the necessity of paying their high freight rates.

A record of the total inadequacy of English canals may be found in the Parliamentary report above referred to. On the various canal routes from London to Liverpool the most capacious governing locks are 72′×7′×4′; London to Hull, 72′×7′×3½′; London to ports on the Severn, 75′×14½′×4½′; Liverpool to ports on the Severn, 72′×7′×4′, and the same from Birmingham to the Severn. The canal boat of 30 or 40 tons burden, though on some routes it can only be loaded with 24 tons, can not be trusted with safety on the Mersey, and its cargo must be transferred to a lighter to reach the Liverpool docks.

As a system, the English canals seem to have been planned on the same general principles as the railroad from Calcutta towards Afghanistan, viz.: alternating patches of broad and narrow gauges, and the ownership of 1,260 miles of canal out of 2,788, in England, by railroad companies does not seem to expedite traffic on them. This system is to be adhered to in the proposed enlargement of the canal between the Severn and Birmingham, it being the intention to make the portion next to that city only large enough to carry coasters of 200 tons, according to Ryland's *Iron Trade Journal*, whereas we have found that the boats of 240 tons navigating the Erie Canal are too small for profit.

In France the law of 1879 provides that all the waterways of that country shall have locks 126 ft. × 17 ft. × 6½ ft., excepting on the Seine to the Pont de la Concorde the minimum draft shall be 10½ ft., and it is proposed to make all the locks on that river to Paris large enough for sea-going vessels. Yet Paris is not like Birmingham, a manufacturing city.

There is a decided difference of opinion as to the true position of waterways. In England, as here, they are regarded as efficient means of controlling railroad rates, but to a great extent on the continent, and by some in England, it is thought that their proper sphere is to transport those bulky commodities of low value which the railroads are said to be unable to transport without loss, it being held by some that the high cost of English freight traffic is due to the different speeds of the various classes of traffic and its volume. Mr. Conder, in his paper read before the Institution of Civil Engineers, contended that rail and water transportation should complement each other, a view said to have been held by the late Dean Richmond when President of the New York Central, and a writer in the April number of the *Edinburgh Review*, reviewing Mr. Jeans' Railway Problems, asserts, 'there is reason to conclude that nearly a million a year is lost to the railway proprietary in consequence of the carriage of coals by railway to London."

The Cooper Union for the Advancement of Science and Art the gift of the philanthropist of that name to those who have to struggle for a livelihood, and nearly the sole monument calculated to benefit his fellows left by any deceased New Yorker, has been called upon to expend $275,000, nearly the amount of Mr. Peter Cooper's endowment, in rectifying the mistake made by overloading an insecure foundation, besides also losing much of the income from the lower stories of the building for nearly two years, the rent of which was in addition to the cash endowment of $300,000 left by Mr Cooper for the support of the free schools. A statement by the Trustees shows that though the children of Mr. Cooper, ex-Mayor Cooper and Mrs. A. S. Hewitt, have determined to reimburse to the endowment fund the cost of the reconstruction of the lower part of the building, the probable income will not exceed $25,500, while $45,000 is required to carry on the schools and reading room in their present state of efficiency. And there are already applicants enough to justify the trustees in doubling the accommodations now presented. Although the two lower stories of the building have much of the time been hung up on shores, the attendance for the past year has been, at the Women's Art School, stenographic, type-writing, and telegraphic classes, 409 scholars, and at the night schools of science and art, 3,389, besides an average daily attendance at the reading room of 1,800 readers. The Woman's Art School is intended to fit its scholars for self-supporting positions, either as teachers in other schools or as designers or photographers, and during the last year the aggregate earnings of 126 pupils amounted to $22,682. Mr. John F. O'Rourke, who is the engineer in charge of the construction of the Poughkeepsie Bridge, is a graduate of the scientific school.

The trustees hope that a consideration of the great good accomplished by the Cooper Union will lead persons able to do so to increase the endowment to $1,000,000. While the Union is as well managed as at present there are but few better dispositions of money possible.

The Richmond & Danville's summer time-tables and new books of rules, issued by General Manager E. B. Thomas, who, it will be remembered, is a member of the committee that made the uniform code, are excellent specimens of what may be termed the normal method of getting up such documents, as contrasted with the "crazy quilt" work of the old dispensation. The Richmond & Danville is a recent consolidation of somewhat incongruous parts, and Mr. Thomas, more than most managers, might be deemed excusable if he did not get hold of improved methods very fast; and yet his plan and arrangement are among the best, if not *the* best, that we have seen. When one reads these time-tables he feels indeed as if clothed and in his right mind. There is no snarl of ungrammatical conditions and exceptions; no blindly expressed references to the book of rules and no marginal notes tipped up edgewise to make the reader cross-eyed. The time-tables proper have the indications for stops, flag stops, meal stations, etc., strictly according to the uniform code, and have explanatory references for these at the bottom of the columns; aside from these there are no notes whatever except the statement prescribing in which direction trains having superior rights are run, and what portions of the road are subject to special dispatcher's orders. The last page of each district table has a small number of special rules compactly arranged and placed so as to be very easily found and easily kept in mind, there being no extraneous or unimportant matters brought in, and the typography being first-class and in good taste. There is a good deal in this last feature.

An item in the "Scrap Heap" tells of the provision made on French railroads for furnishing a meal at the stations for a uniform low price, virtually about 20 cents for the food (10 being allowed for the wine). Although the item from which we copy does not say so, this arrangement doubtless is made in the interest of trainmen and other employés, and is a sensible move. The trainman's lot in this respect is bad enough at best, and everything possible should be done to ameliorate it. In this country the traditional railroad-restaurant-fiend has found some of his most profitable victims among passenger brakemen and others in similar circumstances; not that they have always made these men eat the very hardest grade of No. 2 red-winter doughnuts or always compelled them to pay 15 cents per square inch for lead-lined anti-friction pies; but the necessities of the case have compelled the trainman often to submit for a long time, until his whole moral character was undermined.

The lawlessness with which passenger-train men repair to the lunch counter at way stations and attend to their own wants when their duties demand that they be attending to those of the passengers at the train has been a common annoyance in this country, and is not wholly done away with even now. The Pennsylvania road has done a good thing, though on a small scale, in arranging for trainmen's meals at a moderate price in the dining cars. If these cars were run on a larger number of trains the benefit to the men would be considerable. The giving of three or four courses of meat, seven kinds of ice cream, a French menu, and other things corresponding, and in a $20,000 car, all for 25 cents, throws France and its cheap wine far in the shade.

Split-switches are blamed for two recent derailments of important trains, a California excursion on the Fitchburg road at Pownal, Vt., June 6, and a heavy express train on the New York Central at Spuyten Duyvil, June 10. Both trains were moving at a comparatively low speed and nobody was killed in either case. The Fitchburg train seems to have been on a cross-over track which was not regularly used for passenger trains, but the Spuyten Duyvil switch is at an important junction, and was doubtless regarded as no better and no worse than hundreds of switches on the main line, where trains run at high speeds. No very conclusive evidence has come out concerning either case; and, in fact, the trackmen at both places put the fault on the wheel or axle; and they will very likely show (to their own satisfaction) that the chances are at least half in favor of their theory. This again shows the desirableness of an impartial investigating authority like that of the English Board of Trade referred to in the excellent letter of "K." in last week's *Railroad Gazette*. As long as the protection of self-interest continues to be the first law of nature, different departments will try to shift responsibility for mishaps on to each other. We have the State Commission, to be sure; but its plans would have to be considerably reorganized before it could properly attend to all the accidents demanding investigation. Such disasters as the Bussey Bridge get pretty well aired even in this country; but the English learn many profitable lessons from less serious ones.

The degree of intelligence necessary in trainmen is referred to in a letter from "E. M. F." in another column, wherein he suggests that getting men fit for the business is a better way of meeting the problem than to stick to the old way of making the business fit the men. This is a thought that should receive more attention than it does. Numerous improvements in the general standard of intelligence and fitness in the great body of trainmen on the roads of this country have taken place in the last 30 years, and are plainly noticeable, but many of them seem to have in a manner forced themselves forward rather than to have been the subjects of deliberate ordering on the part of managers. Much of this conservatism doubtless is rooted in the belief that men who will work on a freight train or do "flagging" in cold winter nights are not hopeful candidates for scientific instruction or for places requiring a higher order of intelligence. Admitting this, for the sake of argument, it might be queried whether the experience of the past as regards collisions and other train "accidents" has not been such as to suggest the desirability of getting a higher order of talent even for the present duties on trains, not to mention prospective needs. Perhaps when we have trains made up in such a manner as to require more intelligence in the crew, an improvement may be visible in the ordinary train management.

The Railroad Commissioners, national and state, have a standing invitation to participate in the discussions of the Master Car-Builders' Association, as will be seen by reference to the report of the annual meeting of that body. This is a good sign, and an indication of the growth of scope and influence that characterizes the Association. The Association has great influence for good with the railroad companies, and it is encouraging to think of that influence extending to the commissions as well. Complaint has heretofore been made, and generally with justice, that commissioners were often impractical, or worse. This invitation marks an encouraging change in this respect, and points the way to remedy the defect. The National Commission will probably not meddle with mechanical or other questions connected with methods of physical operation for a good while yet, if, indeed, it does not assume that these are not intended to be covered by the 12th section, which gives power to *inquire into the management of the business* of the roads; but questions of uniform appliances will probably come before some national tribunal sooner or later.

The *Official Guide* gives an account of the business that has thus far been brought before the Inter-state Commerce Commission in a shape that is quite novel. All the various railroads and transportation lines that have had any matter before the Commission, or that are specifically affected by any of its decisions, are arranged in alphabetical order, and notes giving dates and brief information are given under the heading for each road. While very brief and in the nature of an index, this synopsis affords a very handy means of reference.

The June crop reports are, so far as received, fairly favorable generally, and in some regions especially so. Texas reports the corn and cotton crops as "magnificent." In Dakota, Minnesota and Oregon the wheat crop is said to be above the average; in Michigan, however, it is rather below. The Illinois crops are in fair condition, and corn is above the average in acreage and in condition. The agents of the Canadian Pacific report crops in Manitoba and throughout the Northwest in "very fine condition."

From the annual report of the Chicago, Rock Island & Pacific just published, it appears that out of the 7,800 tons of steel rails laid during the year 6,650 tons were of a 70-pound section. That is 10 pounds heavier than the standard heretofore used. Iron pipe has been put in culverts to the extent of 5,600 ft. The diameters vary from 16 in. to 48 in.

Professor Hadley's book "Railroad Transportation, its History and its Laws" has recently been translated into French by Messrs. Raffalovich and Guerin.

NEW PUBLICATIONS.

The *Journal of the Association of Engineering Societies* for June contains papers on Transmission of Natural Gas, Anchorage of Suspension Bridges, Progress of Metallurgy in

1886, The Chapin Wrought Iron Foundations of the Central Viaduct, Cleveland; Notes on Municipal Public Works, Memoirs of T. E. Sickels and C. W. Lunt, and the regular Index to Current Technical Literature.

The Michigan Year Book, of which the third edition (1887) has just been received from the Passenger Department of the Michigan Central, is a very compact and full hand-book about 4×7 in., in which are gathered a gazetteer of the and a variety of statistical information concerning its railroads, industries, laws, history, institutions, etc. The Michigan Central Railroad occupies so modest a place among the other topics that the reader is left in doubt whether the book was i sued as an advertising device, or (its price being given as 25 cents) simply as a business venture on its merits.

The "Legal Hints for Travelers," compiled by Myron T. Bly, of Rochester, N. Y., for the *Pathfinder Guide*, and which have appeared in that lively publication for several months past, are now gathered in a pamphlet the size of the *Baby Pathfinder*, and offered for sale—or perhaps gift, as we see no price named. We have not compared the various decisions compiled by Mr. Bly with the thousand others that might be found bearing on the same points, and so cannot say that this counsel, given at so much below lawyers' regular rates, is invariably infallible; but the general impression after reading them is, that they are accurate and sensible, and calculated to give the lay reader a very fair view of the rights and duties of travelers.

Record of New Railroad Construction.

Information of the laying of track on new railroad lines in 1887 is given in the current number of the *Railroad Gazette* as follows:

Fort Worth & Denver City, north from Quanah, Tex., 64 miles, 14 miles since last reported.

Suffolk & Carolina, from Bosley to Hobbs' X Roads, Va., 6 miles.

New Jersey Junction, from Weehawken to Jersey City, 5 miles.

St. Louis, Oak Hill & Carondelet, from St. Louis to Carondelet, Mo., 11 miles.

This is a total of 36 miles for the week, making 1,620 miles reported thus far for the current year. The new track reported to the corresponding date for 16 years has been:

Miles.	Miles.	Miles.	Miles.
1887.....1,620	1883.....1,900	1879.....732	1875.....336
1886.....1,203	1882.....3,965	1878.....582	1874.....603
1885.....667	1881.....1,872	1877.....595	1873.....1,387
1884.....1,077	1880.....1,708	1876.....656	1872.....2,239

This statement covers *main track only*, second or other additional tracks and sidings not being counted.

Kapteyn's Metallic Brake Pipe Coupling.

(*For illustration see page 396.*)

The coupling shown herewith is designed and constructed by Mr. Albert Kapteyn, Manager of the Westinghouse Brake Company in England. We are indebted to *Engineering* for the illustration and description. It is said that after a thorough and satisfactory trial, the Belgian State Railroad authorities are now bringing it into use on their system on a large scale, and it is also on trial on several other railroads in England and abroad.

It will be seen (fig. 1) that each coupling has three linked joints *A B C*, of which *A* and *B* are identical, whereas *C* is of a somewhat different form. Each joint consists of a rubber ring 3 pressed on to its seat in the case 5 by a cap 2 and holder 3, and resting with its face in a circular groove of the other half of the joint. The two halves of the joint are kept together by the set screw 6, which, however, is only screwed up just far enough to bring the parts together. The joint, therefore, remains exceedingly easy, and has hardly any other friction to deal with than that of the rubber ring 3 against its metal seat on account of the air pressure, which weighs on it from the inside. This arrangement makes the joint easy to manipulate, and also increases its durability, because it is scarcely necessary to point out that great friction causes rapid wear. This peculiar form of joint has, moreover, the advantage of not being much affected by a slight amount of wear, should this ultimately take place, because the rubber ring 3 is flexible, and the air pressure at its back always forces it forward against its metal seat so as to make a perfect air-tight joint.

The groove, in which the face of the rubber ring 3 moves, is coated with a layer of white metal so as to avoid rusting of the malleable iron parts, of which most of the pieces of the coupling are made. This coating of white metal has, moreover, the advantage of further reducing the friction.

As already pointed out, the joints *A* and *B* are identical. The joint *C*, although slightly different in construction, is built on the same principle and is composed of a swivel piece 9 screwed and riveted to a brass piece 12, the lower end of which turns in a socket 8. The nut 10 presses the rubber ring 3 against the socket, and at the same time brings the circular groove of the swivel piece 12 against its lip. The nut 10 is screwed down tight, but all the other parts bear loosely against each other, and therefore the joint is very easy in its movements. Again, in this case the air pressure itself brings the rubber ring against its white metal face, and thus secures a perfectly air-tight, easy and durable joint. The centre coupling (joint *K*) is exactly the same as the well-known standard Westinghouse coupling.

Fig. 1 represents the coupling arranged for use between carriages; whereas fig. 2 is intended for the connection between engine and tender. In the latter arrangement the centre joint *T* is exactly the same as the joints *D* and *E*, and throughout these couplings the same rubber ring is used as that in the standard Westinghouse coupling joint, which greatly facilitates repairs.

Mr. Kapteyn states that he has tried the same coupling for steam, and that he has obtained very satisfactory results with specially vulcanized rubber rings.

The Board of Trade returns show that most of the so-called failures of compressed air brakes are caused by the rupture of the rubber hose-pipe, thus bringing about unexpected stoppages of the trains, which it would be desirable to avoid, although we have frequently pointed out in these columns that under a good system of signaling a train ought not to incur any danger on account of such stoppages. In fact, railways ought and are considered to be worked in such a manner that a train can safely stop on any point of the line. The Brighton Railway officials have published in the Board of Trade returns very interesting figures which illustrate this contention. They have on several occasions noted down the number of times the Westinghouse brake has been used over the whole system in one day, and they arrived at a figure of over 20,000. Of these only about 8,300 were booked stops, and therefore the trains were brought unexpectedly to a stand from 11,000 to 12,000 times in one single day. If opposite these large figures we put the fact that unexpected stoppages on account of burst here are on an average on each line less than one per day it will at once be seen how insignificant this matter is from the point of view of creating danger to a train. But there is another side to the question, viz., the maintainence of these hose-pipes, which is a matter of some importance so long as the life of a hose is not greater than that of hose as now used.

The Peckham Steel-Tired Cushioned Car Wheel.

(*For illustration see page 398.*)

The construction of this wheel is well shown in the cuts herewith. In fig. 1, the parts are designated by letters thus: *A*, steel tire; *B*, double plate centre; *C*, interchangeable clutch jaw hub; *D*, hub flange with clutches; *E*, adjustable hub flange; *F*, vulcabeston cushion; *G*, tongue and groove tire connection; *H*, sectional retaining ring; *K*, riveted hub bolts; *M*, riveted tire lock bolts; *X Y*, line of contact.

The independent double plate centre is made of soft, tough cast iron, and provided with a 3½ in. rim, to which the steel tire is secured by a solid tongue and groove connection, as shown in fig. 2. This connection being on the side opposite the flange, it is supposed the rail will retain the tire upon the centre (even if broken in pieces) without the aid of any other fastenings; but, when wished, retaining ring connections are furnished, either double or single, as shown in figs. 1 and 3.

Fig. 4 is a perspective view showing the jaw hub with clutches. The clutch jaw hub is also soft, tough cast iron, and provided with clutches which lock into jaws in the base of the centre, thereby making a firm, rigid connection not dependent upon bolts. As will be observed, this connection being on the side opposite the connection between the outer rim of the centre and the the tire, makes the line of contact between the tire, centre and hub on an angle of about sixty degrees, and the wheel practically as one solid piece, without relying upon bolts for strength. The bolts used in the connection between the hub and the centre are provided with riveted heads, and serve only to retain the base of the centre against the rigid flange of the hub, and as the pressure of the flange against the rail serves the same purpose, the bolts have consequently very little service to perform.

To give additional strength, durability and safety to the wheel by preventing crystallization, as well as to render it noiseless, there is inserted between the centre and the hub a tubular elastic cushion, constructed of a special preparation of rubber and hemp, so compounded as to make it fibrous and firm, and unaffected by heat or cold, oil, steam, or water, and consequently practically indestructible.

The steel tire (2½ in. thick) is constructed of best Siemens-Martin cast steel. All parts of this wheel are interchangeable, and each part can be renewed when desired without renewing the remaining parts.

It is claimed by the makers that the fibrous cushion will reduce vibrations in the metal, and thus lessen breakages, and that by the same appliance smoother and less noisy running will be secured. The makers are the Peckham Car Wheel Company, 37 North Salina street, Syracuse, N. Y.

Gold's Interchangeable Steam Coupling with Thermostatic Trap.

(*For illustration see page 399.*)

Cuts A and B show a new coupling for steam hose lately devised by Edward E. Gold, Esq., of New York. Both parts are exactly alike and are interchangeable, and to each part a small expansion trap is attached, which keeps the coupling and connecting pipes free from condensation, and thus prevents freezing. It is operated on the gravity lock principle. The face of each coupling is fitted with composition packing of Jenkins' or other make. Each part has one face with inclined plane, on which a V-shaped slot, terminating in a circular socket, is cut, and an arm on which is an oval lug that slips through the slot into the socket. When the coupling is held in horizontal position the lugs on an arm of each coupling slip into the sockets of the opposite coupling until they reach the sockets. When allowed to drop, the arms of each coupling with the lug as an axle slide around the inclined plane on the face of the opposite coupling until it locks on the principle of a cam. Thus, when the hose between the cars is coupled and the cars are drawn apart, the coupling holds until the tension stretches the hose and coupling to a horizontal line, when it uncouples automatically.

References to fig. 1: *A*, inclined plane tightening coupling by means of arm *N*. *B*, body of coupling. *C*, one side hard rubber and the other babbitt metal disk. *D*, hose nipple attachment. *E*, trap on coupling. *F*, diaphragm in coupling. *G*, hard rubber seat for diaphragm. *H*, head of trap (removable). *I*, lock nut on same. *J*, 5-ply steam hose. *K*, lip union female. *L*, wedge shape ring in union. *M*, male part of union. *N*, arm tightening coupling on inclined plane *A*.

References to fig. 2: *B*, 1 in. check valve. *D*, 5 in. diameter storage steam heater. *K*, shield to protect feet from hot pipes. *N*, 1 in. nipples. *P*, 1 in. pipe. *S*, 1 in. elbow. *V*, 1 in. angle valve. *A*, No. 4. Gold's 1 in. lip unions. *A*, No. 10. 1 in. special steam stop cock. No. 16. Interchangeable couplings with thermostatic traps combined. *d*, air brake pipe. *g*, air brake hose. *m*, air brake coupling. *p*, whistle hose. *v*, whistle coupling.

This coupling is made by Messrs. E. E. Gold & Co., Frankfort and Cliff streets, New York.

The Canadian Pacific Locomotives.

A paper, by Mr. F. R. F. Brown, Mechanical Superintendent of the Canadian Pacific, was read before the London meeting of the Institution of Mechanical Engineers, May 16, describing the locomotives designed by him for the service of his line. An abstract of the paper and discussion is given below.

In all cases of service the dead or non-paying weight hauled forms a much greater percentage of the total train than on an English railway. This is partly due to the fact of the freight cars having to be protected against the climate, and to the employment of specially designed refrigerator cars and ventilated cars for the carriage over long distances of perishable goods, such as fresh meat, fish, butter, cheese, etc. It is also partly owing to the strength of the passenger coaches being greatly increased with a view to the safety and comfort of the passengers. A portion of the traffic is worked by wood-burning engines. For coal-burning engines the quality of the fuel is very variable; some of the coal is of such a kind as to necessitate rocking grates with dumping arrangements, sharp blast, and netting for arresting sparks; all of these appliances have to be used for maintaining efficiency, but they are somewhat detrimental to economy, inasmuch as to some extent they react upon each other. In England, the express engines, some of them burning the best Welsh coal, have a very different array of circumstances to contend with, which is usually overlooked when comparing the relative performances of the two types of locomotives. The general designs of the engines which form the subject of this paper are of the American type, as being the best adapted for overcoming climatic difficulties, giving, as it does, a flexible wheel-base, to suit the road when disturbed by frost and thaw, affording easy access to all parts of the mechanism, and enabling necessary repairs to be effected with the greatest facility—all of which points are of great moment for enabling the traffic to be carried on without stoppage for repairs.

In order to get the traffic through, it is considered of more importance that the engines should haul the largest possible loads with such economy as can be obtained, than that they should haul smaller loads at a cheaper rate per ton in regard to fuel. The passenger service on main lines is more often a combination of express and local than either one of these chiefly. Thus the majority of through express trains have to stop at nearly all stations either by time-table or by signal. Special care is therefore required in designing the engines so as to combine free running with the quickest possible starting power; and a continuous brake is also rendered necessary as well as expedient for economizing time in stopping.

The lightest class of engine, designated S. A., was specially designed with a view to condense the stock of patterns and at the same time to give the best and most satisfactory results, whether working on the Atlantic or Pacific coast or on the prairie or rocky sections intervening, with all the extreme variations in class of coal from anthracite to almost lignite, and of water from lime to alkali, which are encountered in operating a railway across 3,000 miles of country. For obtaining the requisite adhesion with this class of wheel-base, and for economizing weight, great care has been exercised to reduce the weight of the front end of the engine without impairing its strength or diminishing the protection in case of collision; and the maximum weight obtainable has been placed on the driving wheels. Equalizing bars are placed between each pair of truck wheels and also between each pair of driving wheels. This class of engine has 17 in. by 24 in. cylinders and driving wheels 5 ft. 2 in. in diameter. The weight of the engine in working order, that is, with two gauges of water and with fire in the fire-box, is distributed as follows: On truck, 30,900 lbs.; on drivers, 53,900 lbs.; total weight, 84,800 lbs. According to the usual formula the tractive force is nearly 112 lbs. per lb. of average steam-pressure in the cylinders.

For light passenger service a similar engine is built, classed as S. C., but having driving wheels 5 ft. 9 in. in diameter, and a casting is inserted above the truck centre to raise the front end correspondingly. The distribution of weight is as follows: On truck, 31,600 lbs.; on drivers, 58,100 lbs.; total weight, 89,700 lbs. The tractive force is 100½ lbs. per lb. of average steam pressure in the cylinders. The capacity of tender for both these classes is 2,800 gallons of water and 10 tons of coal if required. The water supply along the line is stored in frost-proof tanks, which have a capacity of about 40,000 gallons, and are distributed at intervals varying from 10 to 25 miles, and averaging about 16 miles. The tender capacity is sufficient to carry water enough for running two of these intervals, in case the supply at any tank should be stopped from external causes. As the railways are worked in divisions of about 110 to 140 miles, the coal capacity of the tender allows of carrying enough to serve for a round trip, wherever the exigencies of the coal supply render this advisable.

The boiler of the S. A. class, and, in fact, of all these locomotives, is of the "wagon top" style.

As the upper portion of the fire-box is wider than the shell between the frames, this necessitates putting in the inside box in a special manner. The writer's practice is to put it in from the front, before riveting in the front sheet or front plate of the shell, which is put in afterwards, the connection being made between barrel and fire-box by a double-riveted joint. The foundation ring is 2⅝ in. deep and 3 in. wide at sides and back, and 3½ in. wide at front; it is single riveted all round, with ¼ in. projection below the plates to allow for solid calking. It is forged from scrap-iron, and welded together at the centre of each end. It is then machined all round, inside and outside, and the corners are tapered for the scarfing on the plates. The outer plates are scarfed very carefully, to extend about 2½ to 3 inches beyond the edge of the plate, sufficient material being left on the edge of the plate to give this length of scarf. This allows of three rivets for holding the plates close to the outer corner of the ring, and effectually prevents the plates at the corner from being sprung away by the calking. The inside corners of the fire-box tube and back plates have ⅛ in. internal radius, and the scarfing on the side plates is brought well round the outside of the tube and back plates. There has not been a single instance of one of three corners giving trouble by leaking. The fire-hole is elliptic in form, 16 in. long by 14 in. high. It is formed by flanging the two back plates outwards, and a welded sleeve of Yorkshire iron, 5$\frac{5}{16}$ in. wide by ⅝ in. thick, is in-

serted between them, which is riveted to the inside box before the box is put in place. The flange for the outer plate extends beyond the sleeve, to form a backing for calking the sleeve, and to allow the fire-door to fit against it. This form of fire-hole gives no trouble by leaking, and its flexibility allows the inside box perfect freedom for vertical expansion and contraction.

The fire-box crown is not quite flat, having ½ in. rise in the centre from each side for preventing deposit of scale from occurring through deflection of the roof plate in the centre, which sometimes happens with flat tops. The front portion is supported by ten lateral crown bars or roof girders, and the after portion by five rows of direct stays, with ten in each row. The crown bars consist of two wrought-iron plates, 5 in. by ⅝ in., set 1 in. apart, and have cast-iron blocks between the ends, forming feet to fit the curve of the crown plate and to rest on the top edge of the side plates of the fire-box. Each crown bar is secured to the roof plate by ten bolts of ⅞ in. diameter with taper fit, driven upwards through the crown plate, and having a fluted head below, with a copper washer between the head and the plate; the head is fluted round the bolt for the purhose of leaving room for any burr on the edge of the plate, and for enabling the annular face of the head to fit up solidly against the plate and make a perfect joint with the copper washer. The head is of the snap or cup form, in order to give as little projection for deposit as possible. The crown bar is 2½ in. above the plate, giving ample water space between, in which are placed cast-iron ferrules on each bolt, having the bottom face of the same diameter as the bolt head below the plate, while the upper face is made large enough to give the crown bar a solid bearing on it. The washer on the top of the crown bar has its edges bent down at front and back, so as to clip the two plates of the bar and keep them from any tendency to spread. These bars are spaced equally with the rows of direct stays, at a uniform pitch of 4 7/8 in. longitudinally, leaving 2½ in. between the lap of the joint and the front row. The bars are hung in pairs from the external shell by a series of braces on each side, which are connected by a stirrup and pin to the crown bars and to brackets on the boiler; three brackets are riveted in the dome on each side, and two on the shell on each side; those riveted to the dome assist materially in preventing any deformation of the shell owing to the large size of the hole cut in the shell plate. Allowance is made in all the braces for upward expansion of the fire-box. The direct stays are 1⅛ in. in diameter, screwed with eleven threads per inch, and riveted over the plates on the outside of the shell and on the inside of the fire-box, excepting only the outer row on each side, which are not tapped through the shell, but are screwed into hangers in pairs; the hangers are secured by pins to brackets on the shell, similar to those which carry the crown-bars; the brackets are all of mild cast steel, and of light pattern. The hangers have allowance for upward expansio on the side plates of the fire-box.

This system of staying presents advantages. Crown-bars are preferable to direct stays for the forward part of the roof-plate, inasmuch as they allow considerable movement of the fire-box while firing up, and the grip of the roof bolts prevents the roof from buckling, which invariably occurs from the direct contact of flame. Tais does not apply to the back end of the crown, where there is very little flame contact; and the absence of crown-bars on this portion materially assiits in keeping the crown of the box free from deposit, and in removing it when formed. The back plate of the shell and the smoke-box tube plate are supported by gusset stays attached to the top of the shell and barrel. Those on the back plats have the angle irons continued down to relieve the strain on the top row of stays to the inside box. The taper plate of the wagon top is prevented from extending by four braces from the line of the bottom joint of the taper to the gusset stays on the back plate. A row of cross stays 1⅛ in. in diameter, screwed eleven threads per inch, are tapped into the shell from side to side between each crown bar and each row of crown stays, and are placed 2½ in. clear above the crown. These cross stays prevent the flat sides of the waggon top from bulging out, and relieve the top row of side stays from undue strain, thus avoiding trouble from broken stays. Three cross stays are placed for the same purpose in the taper course above the back end of the tubes, each being connected by pins to a pair of stiffening angle irons which are riveted to the oval sides of this course. All side, front, and back stays for the fire-box are ⅝ in. in diameter, screwed eleven threads per inch, and riveted outside and inside. The tube plate is stayed to the barrel below the tubes by four barrel stays with studs through the tube plate.

The dome is 2 ft. 4 in. in diameter outside by 2 ft. 6 in. high to joint. It is flanged out to the shell and double-riveted; and the shell is strengthened by an extra thickness of plate, which also takes the dome rivets. This plate and the shell project inside the dome far enough for a row of rivets, thus reducing the hole in the shell to 2 ft. ¼ in. in diameter, and tending to prevent priming from being started by splashing.

The boiler is built entirely of Siemens-Martin mild steel plate imported from Scotland. The barrel is 52⅛ in. in diameter outside at the smallest course, and 11 ft. 4¼ in. long, the plates being 7/16 in. thick. The fire-box shell is 6 ft. 7⅝ in. long by 3 ft. 6½ in. wide outside between the frames, and inside 5 ft. 11 3/16 in. long, by 2 ft. 11 in. wide at bottom and 3 ft. 6½ in. at top. The depth below the centre line of the boiler is 4 ft. 8 in. to edge of plate, and the height above the centre line is 11 in. at sides and 11¼ in. at centre. The thicknesses of plates are as follows: Front and back tube plates, ½ in.; back and side plates inside, 5/16 in.; back plate and top of shell, ½ in.; sides of shell, 7/16 in.; top of inside box, ⅝ in.; dome, 7/16 in.; smoke-box, ⅜ in. Cleaning plugs are inserted as follows: One in each corner at bottom of box, two in each side in accessible position, one in front of shell at bottom, and one close under the barrel; five across the back plate just above line of crown, six in front of tube plate—namely, two above tubes, two at sides and two at bottom. Two hand poles, 2¼ in. in diameter, are placed on the taper plate, to afford access to the back end of the tubes, and to wash the deposit down into the leg of the fire-box. The boiler work is all sheared, punched and riveted by hydraulic machinery on Tweddell's plan, the rivets being all of very mild Siemens-Martin steel, except in the foundation ring and where hand riveting is necessary, in which case Lowmoor rivets are used. The crown stay bolts and all screwed stays are of the same quality of steel as the rivets. The flanging is done by hand on special blocks, and the plates are heated in a furnace, and annealed after flanging whenever they have been locally heated. The edges of all plates are planed to an angle of 75 deg. before being put together. The longitudinal seams are double riveted zigzag with lap joints; and the circumferential seams are single riveted, except the connection between fire-box and barrel, which is double riveted. The tubes are wrought-iron lap welded, of German or American make, 185 in number, 2 in. outside diameter, No. 12 B. W. G. thick (0.11 in.), 11 ft. 8¼ in. long between tube plates; and are arranged in vertical rows, all being kept clear of the ⅜ in. internal radius of fire-box tube plate. The smoke-box tube plate is drilled 1/16 in. larger than the tubes, and the fire-box tube plate to net size; the tubes are swaged down at the back and through about an inch length, sufficiently to receive a copper ferrule 2 in. outside diameter and No. 18 B. W. G. thick (0.05 in.), which is driven on, and the tubes are then inserted in place, and rolled tight at both ends with a Dudgeon expander, and beaded at the back end only.

The heating surface is as follows: Tubes (external), 1,132 sq. ft.; fire-box, 112.5; total, 1244.5 sq. ft. The grate area is 17.3 sq. ft.

These boilers are built to carry a pressure of 150 lbs. per square inch, and are tested with steam to 165 lbs. The hydraulic test is not generally used by the writer, as it is considered by some engineers that the structure is damaged to some extent by the excessive pressure. Hydraulic pressure has, however, been applied up to 220 lbs. per square inch, in order to test the soundness of the design, and the result was very satisfactory.

The regulator pipe is carried in the dome by a wrought-iron strap; and has a drooping flange or collar cast on near the top, to prevent water from creeping up the pipe and causing priming to start. The main steam pipe is of wrought iron, lap welded, 5¼ inches in diameter inside, and ¼ inch thick; it has a cast iron sleeve riveted on at each end, with a copper joint for calking. The joints at each end are ball-shaped and ground tight; the back face of the front sleeve forms a ball joint to the tube plate, and the T pipe studs make the two joints at this end. The joints between the branch pipes and the T pipe are made with a brass ring, having a ball joint at one side and a flat joint at the other, and both joints are ground. Similar joints are made between the branch pipes and the cylinder casting, which projects inside the smoke-box for convenience. The branch pipes are 4⅛ in. in diameter at each end, and the centre portion is made of oval section, so as to leave the space in front of the tubes as open as possible.

The exhaust pipes are in one casting, so made as to get the exit as low as possible; each exit is on the top of the pipe, and forms a semi-ellipse divided by a web of metal; on this face is bolted the nozzle, which is 7 in. high, and the tip is 3¾ in. diameter, being very slightly larger than the exit from each pipe. Thus the nozzle does not contract the steam passage, and therefore avoids blowing over into the other cylinder; but it serves to convey the jet of steam to the centre of the petticoat pipe and chimney, thus producing the maximum effect as an ejector.

The chimney or stack for coal burning is 16⅛ in. diameter inside, and has the base casting made in two parts, one bolted permanently to the smoke-box, and the other riveted to the barrel of the stack, with a turned joint between them. This admits of the stack being readily changed for repairs, or for wood burning if required. The stack is of the diamond type.

The ashpan is constructed with dampers each end, which are worked from the footplate; and the bottom is slightly curved up at each end, to hold water if required. It is carried by studs tapped into the foundation ring, and is secured by cotters for easy removal. Ashpans for wood-burning engines have a fine netting screen inserted inside each damper to prevent the ashes from being blown out.

For coal burning the grate consists of cast-iron cross-bars, which are pivoted at each end on side bearers carried by studs in the foundation ring. The cross-bars have a series of alternate fingers at each side, placed so that the fingers of one bar extend between those of the next and leave ⅝ in. air space all round; the body of the bar is also perforated with air spaces. The bars have levers below, connected with a coupling rod, which is worked by a lever from the footplate, so that they can be rocked on their bearings to break up all clinkers which may be forming, shake down the ashes and clear the fire. The two front bars are replaced by a dump, where required, so that any clinkers which may be formed can be dropped into the ashpan without dropping the fire; the dump is also worked from the footplate. The wood-burning grate is formed by two rectangular shelves running round the firebox, the upper about 10 in. wide and the lower about 6 in., each sloping down toward the centre, and open in the centre; a third similar shelf below is closed in the centre formidg a sort of tray, which is the bottom of the grate. A vertical space of 3 in. for admission of air separates each. The two lower are each carried from the one above, and the top one by side bearers in the fire-box.

The saddle between the frames is an independent casting, bolted to the smoke-box and fitting the frames, with flanges on inside and on top. Each cylinder is fitted to the outside face of the frame, and is bolted with driving bolts, which also secure the inside flange of the saddle. The cylinders fit between lugs on the top of the frame and on the top flange of the saddle; and the cylinders and saddle are keyed in position. The cylinder casting has an extension, forming the steam and exhaust passages, and connecting the cylinders with the smoke-box; this extension is securely bolted to the smoke-box and the saddle. This plan admits of either cylinder being taken off for repair or renewal, without interfering with the saddle or frame, enabling the work to be done in the shortest possible time and at the lowest cost. The steam chests are placed on the top of the cylinders, and are removable, so that refacing or repairs to the valve seats can be done rapidly and conveniently. The joints at top and bottom are made with copper wire, and the studs which hold the cover also secure the chest in place. The steam passage being cast in the cylinder enters the chest at the bottom, behind the valve seat. The chests are placed as close in as the smoke-box will admit to afford protection. The steam ports are 16 in. by 1¼ in., and the exhaust port 16 in. by 2⅝ in. The valves are of the Allen type with 7/8 in. supplementary port in four sections; the lap is 1 1/8 in. and the lead ⅛ in. bare. The travel in full gear is 5½ in., the throw of the eccentrics being 5 in. Very satisfactory results are being obtained for economy, efficiency and speed. All the valves are of cast-iron of the same quality as the cylinders, and no scraping is done on the faces, because the surfaces, when care is taken at first, become quite polished and hardened, showing that valves of this metal run with a very small amount of friction or wear. The cylinders and steam chests are lagged with wood over a sheet of asbestos cloth, and are sheeted with stiff Russia iron. The cylinder and steam chest covers have casings of cast iron.

The frames are forged from selected scrap-iron under a 30 cwt. Davy hammer, and are each made in two parts, the splice being placed in front of the driving axle and secured with keys and driving bolts. The mode of manufacture of the main frame is to forge the top bar in one piece from end to end, then weld on the horns or pedestals with a split scarf, the welding being done under a 12 cwt. hammer; the bottom bar is then veed in, and the inclined bar at the back end is dabbed on at the top and veed in at the bottom; the lower jaw of the splice is forged together with a portion of the pedestal. The front end or extension frame is made as straight as possible, to obtain economy in forging and machining and is provided with lugs on the top only, to receive the saddle-flange and the cylinder. Across the front end of the frame, and behind the buffer beam, a heavy plate 8 in. wide and ⅝ in. thick, is secured by being checked into the frame and riveted with angle irons to the buffer-beam plate and to the front footplate. This gives protection to the cylinders in case of accident, and has proved to be of great service. Stays are placed to connect the smoke-box with the front end of the frame, so as to add vertical stiffness to the latter. The back end of the frame is secured by a heavy cast-iron footplate, which is accurately planed and well bolted in place. This casting carries a wedge arrangement, for taking up all slack motion in the coupling between engine and tender. Side brackets are bolted to the frame and footplate, for supporting the back end of the running boards and cab.

The pistons are of the built-up class with two packing-rings, bull ring, and junk ring, all of cast-iron. The piston-head is put on the rod with a taper of 1 in 16, and is made sufficiently tight to shrink on, and is then secured by a fine-threaded nut. The piston-rods and slide-bars are forged of mild Bessemer steel. "United States" metallic packing-rings are used for the piston-rods and valve-stems, and give full satisfaction; the rods continue in first-class condition, and a set of packing-rings lasts about twelve months. The cross-heads are of the four-bar type, and are of mild cast-steel, fitted with cast-iron gibs of cylinder metal. The connecting-rods are of Siemens-Martin mild steel, with the oil cups forged solid on the straps. The coupling-rods are forged from best selected scrap-iron, without welding, and with solid eyes and oil cups forged on. Half-brasses and cotters are used in all these rods, on account of extreme cold in winter. The motion proper is of the in-direct kind, in the American style, for allowing free access to the steam-chest. The eccentric straps, expansion links, lifting links, reversing handle and rocker arms are all of mild cast steel of English manufacture. All pins work in bushed ends where required. The weight of the motion is counterbalanced by a semi-elliptic spring, bearing in front of the motion plate, and coupled to a short lever on the reversing shaft. The motion plate is of rolled mild steel, and the valve-rods are of forged mild steel.

All axles are of Siemens-Martin mild steel, and are parallel, except in the centre between eccentrics, etc. The crank pins are of Lowmoor or Bowling hammered bars, and are case, hardened on the journals; the wheels are heated, and the crank-pins being turned parallel are driven in with a large tup and riveted over on the inside. The crank-pins have to best material and extra strong, to withstand the effect of frost in winter, as cases have been known where all four have broken off suddenly when the engine was left standing long.

The driving wheels are of cast-iron, with hollow spokes of egg-shaped section and hollow rim. The counter-balance weight is cast in solid, the rim being cut at each end of the weight in order to prevent damaging the wheel by contraction. The counterbalance is calculated to balance the total revolving weights and one-half of the reciprocating weights. The wheels are pressed on the axles with a hydraulic pressure of eighty tons, and then keyed tightly. The ties are of crucible steel, 3 in. thick, and are secured on the centres by shrinkage only; no other attachments are necessary to secure them, and they can be safely safely worn down to 1¼ in. thickness in winter and 1¼ in. in summer, without becoming loose or breaking. The axle boxes are of cast-iron with brass bearings babbitted. The back horn block is wedge-shaped, with setting up and locking bolts.

The frame of the truck consists of a cast-iron plate or saddle, strongly ribbed, and resting on the top bars of the side frames; it has a lateral space in the centre, to allow the swinging casting to move sideways on four links hung on pins through the saddle. The swinging casting is free to revolve on a centre bolted to the underside of the saddle between the cylinders, thus forming the sole support for the front end of the engine. Each side-frame of the truck consists of two straight wrought-iron bars, connected at each end by a pair of horn-blocks or pedestals. The springs, one on each side of the truck, are placed in the interstices of the frame in an inverted position, so that the weight is transferred direct from the centre of the top frame to the spring buckle, thus relieving the side-frame of the truck from any strain due to weight. The ends of the springs are connected to equalizing bars, one on either side of each spring, which rests on the tops of the axle-boxes. The axle-boxes are of cast-iron, with loose brass bearings babbitted; so that by removing the sponge box and lifting the truck about half an inch the bearing can be removed with the fingers and a new one substituted. The collars on the axles are loose, to permit of this being done. The axles have journals 5 in. in diameter by 8 in. long. The wheels are Krupp wrought iron coiled disks, 30 in. in diameter, with 2½-in. crucible steel tires and Mansell clip-rings. They are put on the axles with a hydraulic pressure of 40 tons.

The boiler is lagged with wood, so as to leave an air space of about an inch, and is then covered with heavy Russia iron, with bands of the same. The dome is similarly covered with the addition of cast-iron base and cap.

The tender tank has a capacity of 2,800 gallons of water and 10 tons of coal. It is mounted upon a wooden frame of white oak, which is strongly braced longitudinally and laterally, and is carried on two four-wheeled rigid-centre trucks. The two springs on the front truck are placed laterally on the cross frame, and of the four springs on the back truck two are placed longitudinally on the side frames and two laterally on the cross frame; thus the tender is carried on three points, and rides very steadily in consequence. The cross frames of the two trucks are of I beams, 10 in. deep by 5 in. wide, and weighing about 40 lbs. per foot, secured at the ends by wrought iron plates and to the side frames by driving bolts. The side frames are of two flat bars, 3 in. by 1¼ in. and one 3 in. by 1 in.; the second 3 in. by 1¼ in. bar is gibbed at the ends to form a truss with the top bar, all three bars being secured to the axle boxes at the ends. The axle boxes are the standard freight car boxes, with removable bearings, so that duplication is carried as far as possible. The axles are of Siemens-Martin steel, and are duplicates of those used under coaches and freight cars. The wheels are 33 in. in diameter, of cast iron with chilled treads. Hand brakes are applied to both trucks, so as to equalize the brake power on all the wheels.

The foregoing S. A. class of freight engines are equipped as S. C. engines for light passenger service by substituting driving wheels of 5 ft. 9 in. in diameter, and adding Westinghouse automatic brake equipment complete, with improved brakes on the driving wheels, arranged to compress each wheel between two shoes so as to neutralize the thrust on the axle. Extra care was taken in calculating and placing the counterbalance weights in the wheels, and a corresponding satisfactory result in steadiness has been obtained. The tender has also the automatic brake, arranged to admit of being worked by hand if necessary; and instead of cast-iron wheels, Krupp wrought iron coiled disk wheels of 33 in. diameter are used, with Martin steel tires 2½ in. thick. The feed water supplied by two No. 8 injectors, one non-lifting on the left-hand side, and the other lifting on the right-hand side.

S. B. HEAVY PASSENGER ENGINES.—These are built on similar lines to the preceding classes as regards type of wheel base and general features. They are especially designed for working very heavy and fast trains, up to ten coaches weighing 60,000 to 80,000 lb. each, and at speeds of 45 miles per hour between stations. Their weight in working order with a double supply of water and with fire in the fire-box, is distributed as follows: On truck, 31,000 lbs.; on drivers, 64,800 lbs.; total weight, 95,800 lbs. The cylinders are 19 in. in diameter and 22 in. stroke, and the driving wheels are 5 ft. 9 in. diameter. The tractive force is thus 115 lbs. per pound of average steam pressure in the cylinders. The wheel base is 23 ft. 6½ in., and the distance between the driving wheels 8 ft. 9 in. The coupling rods are made of I section. The distance from the centre of the driving axle to the centre of the cylinders is 11 ft. 8 in. The springs are underhung, instead of overhead, as in the preceding classes, thereby enabling the boiler centre to be placed lower, and the

riding qualities are very satisfactory. The boiler is 54 in. in diameter outside the barrel, which is all in one sheet from the taper course to the front end, where it is connected with a solid wrought-iron ring 10½ in. wide and ½ in. thick, in which the front tube plate is riveted, thus dispensing with a longitudinal joint crossing the tube plate flange. The barrel is 11 ft. ¾ in. long, and 11 ft. 4¾ in. between the tube plates. The fire-box is 7 ft. by 3 ft. 6½ in. outside, 5 ft. 4½ in. deep from centre line, and 11¾ in. above centre line at sides, to 12¾ in. above at centre. The details of construction are otherwise exactly the same as in the preceding classes, except that the longitudinal seams of the barrel are here double-welted butt-joints, with the inside welt narrow and the outside one wide, the latter being double riveted with wider pitch in the outer row of rivets. The tubes are exactly the same as in the preceding classes, except for length; and are 204 in number. The working pressure is 160 lbs. per square inch. The heating surface is as follows: Tubes (external) 1,235 sq. ft.; fire-box, 134.8; total, 1,369.8 sq. ft. The grate surface is 18.4 sq. ft. The main steam pipe is 7½ in. in diameter inside and $\frac{5}{16}$ in. thick, and the branch pipes are 6 in. in diameter. The steam ports are 18 in. by 1⅝ in., and the exhaust port 18 in. by 3¼ in. Allen valves are used, with the Morse balancing arrangement. The average travel of the valve is 5$\frac{13}{16}$ in.; the lap is $\frac{15}{16}$ in., and the lead $\frac{3}{32}$ in. The steam chest cover is hollow, for the steam to pass to the front end of the valve. The truck has a wrought-iron frame, and the cross frame carrying the weight is of a truss form; the whole being rather lighter and stronger than in the preceding classes. The wheels are 36 in. in diameter, of Krupp make; namely, a wrought-iron coiled disk with steel tire; the axles, axle boxes and hornblocks are duplicates of those in the preceding classes. The feed water is supplied by two No. 9 injectors, one non-lifting on the left hand, and one lifting on the right hand. The engines are equipped with Westinghouse automatic brakes, and also with a double sight-feed lubricator. The tender has a capacity of 2,800 gallons and 10 tons of coal, and is built in a similar manner to the preceding, except in having 40-inch Krupp wrought-iron coiled disk wheels with Martin steel tires.

The Consolidation engine was described and illustrated in the *Railroad Gazette* May 6, 1887.

The author is now engaged in working out the details of a class of Mogul engines with 19-in. by 24-in. cylinders, designed for fast freight service in summer on the heavier sections of the road, and for heavy fast passenger service in severe winter weather. The lines of the S. D. consolidation class have been followed to a great extent, in order to obtain the requisite boiler power; and duplication of parts of former classes is also closely adhered to, not a single new pattern being required. The boiler is similar to that of the S. D. class, the same flange blocks being used. It is somewhat shorter in the barrel, but its centre is the same height above the rails, namely, 7 ft. 3 in., though the wheels are increased from 51 in. to 62 in. in diameter. The bottom of the firebox is made shallower at the back end, to clear the trailing axle-boxes; while the front end is kept to the full depth, to allow sufficient depth of fire below the bottom tubes. The frame is similar to that of the S. D. class, but with three pairs of horns; between the driving and trailing wheels it is forged down to suit the firebox, thereby enabling the boiler centre to be kept to 7 ft. 3 in. height, although driving wheels of 11 in. greater diameter are used. The cylinders are made from the S. D. pattern, but lengthened in stroke to 24 in. and made shallower in the boiler seat. The Westinghouse brake will form part of the equipment; and Delauney's balanced valve will be used. The weight of this class will be about 100,000 lbs., or 44¼ tons, of which about 86,000 lbs., or 38¼ tons, will be on the driving wheels. The boiler will be set to carry 170 lbs. pressure.

COST OF PRODUCTION.—A batch of five engines of the S. A. class which the writer has recently completed, cost, without extras, $5,205 each, or about £1,071; or 2.44d. per lb. for the finished engine and tender. The cost of an English engine, built in the shops of the London, Brighton & South Coast Railway, has recently been given by Mr. Stroudley at 5.57d. per lb. The cost here given by the writer, being less than half that of the English engine, may be regarded with some surprise, and a few leading details will therefore be added. This cost includes all the coal used in the forge, blacksmith's, boiler, and other shops, as well as all small tools and supplies used in the construction of the engines, such as brooms, brushes, candles, chisels, files, hammers, handles for tools, hemp, oil, waste, sand paper, tallow, wrenches, etc.; and also a complete set of tools of all sorts, lamps, oil cans, jacks, dogs and wedges, fire-irons, etc., for the equipment of the engine in running order. But it does not include the salaries of foremen, draughtsmen and clerks, repairs to machinery, maintenance of buildings, water or coal used in the stationary boilers required for running the shop engine. These are not included, for the reason that on some railways such expenses are charged in a lump sum, varying from 5 to 15 per cent., which is added to the cost of the finished engine. In the main shops of the Canadian Pacific Railway these expenses are about five per cent., but in order to put these shops on such a basis as will compare with any other establishment, it is the practice to add 15 per cent. to the cost of both labor and material of the manufactured goods. Hence, by omitting this charge altogether in the cost above given, a comparison can be more easily made according to the varying practice of other railway shops and manufactories.

Detailed Costs.—With regard to the detailed cost of certain portions of finished work for these engines, the forged frames cost 2d. per lb., including scrap (charged out at market value) and all coal; when planed, drilled and slotted all ready for erecting, the frames cost 2⅝d. per lb. The finished boiler ready to go into the frames costs 4d. per lb., the steel plates having to be imported from Scotland, and freight and duty paid. The total cost of cylinders, fitted with covers, studdeu, and ready for erecting, is 2¾d. per lb.; and as the shops do not include a foundry, 2d. per lb. has to be paid for the cylinder castings. The cast-iron driving-wheel centres cost 1$\frac{15}{16}$d. per lb., including cost of freight for over 400 miles. Connecting-rods and side-rods, fixed up with brasses, cotters, etc., all ready for use, cost 7½d. per lb.

The writer has lately built ten engines of the S. A. class and eight of the S. C. class, all of which are sent across the continent and are running between the Rocky Mountains and the terminus on the Pacific Ocean. Appended is a specification of the tests prescribed for materials used in the construction of locomotives built outside the Montreal shops of the Canadian Pacific Railway.

Boiler Iron.—All boiler iron to be best quality Lowmoor, Bowling, or Krupp. A careful examination to be made of every sheet, and none to be accepted that shows mechanical defects. In every boiler one sheet to be ordered 3 in. longer than the size required, from which a strip is to be cut and tested. The piece so tested must have an ultimate tensile strength with the grain of not less than 50,000 lbs. per square inch, an ultimate tensile strength across the grain of not less than 45,000 lbs., and must show a ductility, measured by elongation or reduction of area, of not less than 20 per cent. Should any of the test pieces fail to fulfill the above requirements, the entire boiler may be rejected. Should any plates develop defect in working, they must be rejected. Each plate must be stamped with the maker's name.

Boiler and Fire-box Steel.—A careful examination to be made of every sheet, and none to be accepted that shows mechanical defects. A test strip from each sheet, taken lengthwise of the sheet and without annealing, should have a tensile strength of 55,000 lbs. per square inch, and an elongation of 30 per cent. in an original length of 2 inch. Sheets are not to be accepted if the test shows a tensile strength less than 50,000 lbs., or greater than 65,000 lbs. per square inch, nor if the elongation falls below 25 per cent. Should any sheets develop defects in working, they must be rejected.

Iron and Steel Stay Bolts and Boiler Braces.—Iron or steel for stay bolts and braces must have an ultimate tensile strength of not more than 60,000 lbs., nor less than 48,000 lbs. per square inch, with an elongation of not less than 20 per cent., and a reduction of area of fractured section of not more than 35 per cent. It must also withstand the following test: A piece of the iron or steel from 18 in. to 24 in. in length is to have one end fastened in a vise; over the other end a piece of pipe is to be passed to within 6 in. of the vise. By means of the pipe the sample must be bent until the end is at right angles to the portion in the vise, and then bent back to its original position. This must be repeated not less than twelve times without showing fracture, the bending being each time in the opposite direction to that previous.

Boiler Tubes of Steel or Iron.—All boiler tubes must be carefully inspected and be free from pit-holes or other imperfections. They must be rolled accurately to the gauge required. They must be expanded in the boiler without crack or flaw. When tested, iron or steel tubes must show a tensile strength of not less than 55,000 lbs. per square inch, and a ductility of not less than 15 per cent.

Tubes of Brass or Copper; Brass and Copper Pipes.—Tubes of brass or copper to be of uniform circumferential thickness and solid drawn; to be perfectly round. A piece 30 in. long, annealed and filled with resin, must withstand being doubled until the extremities touch each other without showing defects. A piece 30 in. long, not annealed, filled with resin, and placed on supports 20 in. apart, must withstand bending to a deflection of 3 in. without showing defects.

Bar Iron.—All bar iron (flats, rounds and squares) must be capable of sustaining an ultimate tensile stress of 50,000 lbs. per square inch, with an elastic limit of 25,000 lbs., and a minimum ductility, measured by elongation or reduction of area, of 20 per cent.

DISCUSSION.

Mr. WORSDELL said the point in the paper which had struck him the most was the method of attaching the cylinders, which was very different from the English practice. Another feature of difference was what he described as the wagon-top boilers, which were connected by sloping or taper plates. The practice of flanging was a very late experience in America; the general practice had hitherto been to connect in the simplest possible method either directly or by means of angles. The cast-iron wheels were a notable feature. On the Pennsylvania Railroad, about the year 1866, they had solid cast-iron wheels, the result being that they frequently had cracked bolts and had to depend entirely upon the tires. The hollow-block cast-iron driving wheel was then introduced, and its use had become very general, it being considered to be an improvement. Very little was said in the paper about the use of mild steel for fire-boxes and boilers, but it was the fact that in America they seemed to have been able to use it, while in England they had not done so satisfactorily. It was quite true that there were steel fire-boxes running in this country which had made very good mileage, but as a rule, they kept to the copper fire-box. He thought the main reason why the steel stood so well in America was that they had exceptionably good water. It would be interesting to know whether, on lines where the water was very bad, their mild steel was in satisfactory use for fire-boxes under the high pressures that were carried.

Mr. JOHNSON thought the difference between the cost of production was accounted for by the fact that in England they used brass tubes, copper fire-boxes, and different kinds of frames. He did not know how the steel tires were found to answer, but he certainly should not like to use them without any fastening except their own shrinkage. The author gave the average cost of his engine as 2.44d. a lb. The average cost of six-wheel coupled engines made by him (Mr. Johuson) was 3.3d. per lb., the excess cost being principally due to the use of copper boxes and brass tubes as against steel. Mr. Burnett said his experience in New South Wales showed him that iron fire-boxes were not as durable as those made of copper, and it entirely depended upon the quality of the water as to whether they could be used at all.

Mr. HOLDEN said that steel fire-boxes had been tried on the Great Western, but their experience with the whole of them, both those made by the best English steel manufacturers and those specially imported from America, was very unsatisfactory. They cracked across the rivet holes, and cracked down the corners, and were taken out after doing a comparatively small mileage. The Great Eastern Railway also had a steel fire-box, and that, after doing some 80,000 miles, had to be taken out, having previously been cropped round the bottom. They had a number of engines working with cast-iron wheels and doing very satisfactorily; they did not fasten them on in the American fashion, but used instead Mansell fastenings. They used them for fast goods, but not passenger trains. The Great Eastern some years ago built a number of engines of the Mogul type, which were working up till very recently. They knocked themselves to pieces very badly indeed on the English roads, and in addition the consumption was so great that what with the cost of working and the cost of repairs they had been practically discarded and broken up as fast as possible. The consumption of coal used to amount to something like 70 lbs. per train mile.

Mr. GREIG said that English locomotives were quite unsuited to places like New South Wales and South Australia, in consequence of the state of the roads. He had seen locomotives, second to none in the world, come into Sydney station with the rivets cut off the frames by mere brute force. An American engine would not exhibit such a phenomenon, because of its superior elasticity. The longer he thought upon the subject the more he was impressed with the simplicity of the American locomotive, its cheapness, and the ease with which parts could be replaced. As to the use of cast-iron wheels, he had brought over ten tons of old ones, and asked to have them cast into cylinders, but the men in the foundry said they could not break that sort of wheel. In England we had a better substance for wheels, viz., steel. American boilers were bad from beginning to end, and very inferior to the English. He was at present making six boilers with steel fire-boxes, but they were of short length, and the contraction and expansion did not tear them to pieces, as was the case with the long boxes made in America. For bad roads and for the circumstances under which the locomotives worked, those used on the Canadian Pacific Railway were much better adapted than any English engine that ever was made or ever would be.

Mr. HALPIN approved of the author's steam pipe diameter —5¼ in. It was a move in the right direction, and one which might be followed up in this country with advantage. He was sure that steam-pipe diameters were so large, and the velocity so great, that an enormous amount of power was lost in the cylinder. The Mason try cocks were not considered good in this country, and had been abandoned for a long time. As to the use of cast iron for eccentric straps, he thought that, if there was any place in which it was thoroughly adapted for use in England, it was in eccentric straps and sheaves. The author had stated that the crank pins had broken off when the engine was standing. The same thing had been stated at a meeting of the Institution of Civil Engineers. In Canada during a frost a large number of engines were standing in a shed, and all the tires burst. In regard to wheels he thought that author was inconsistent. They had the peculiar distinction of hanging by the boss into which an axle was forced by a pressure of 80 tons; and on the top there was an unknown splitting force. But with small truck wheels, where there was no danger, the author made disk wheels with Mansell tires, thus going to the very end of the compass. As to the cost of the engines, if the author chose to cast them he could do so. A gentleman of large experience in America had recently told him that the cylinders there were so soft that he wondered why they did not bring them to England and have them cast.

Mr. TOMLINSON said that more than thirty-five years ago he had worked engines with corrugated fire-boxes on the South-Western Railway, but they were given up because there was so much difficulty in getting the stays where they were wanted. He remembered when the Grand Trunk Railway was opened the engines used were those made by the Birkenbead works on the type of the London & North-Western Railway engines. They went well enough during the summer, but in the winter, owing to the inequality of the roads, they went off in all directions, and they had to be altered, a bogie being put in front; they were then able to keep the road. The engines referred to by the author were made upon the most lissome principle imaginable; but he could never ascertain the exact cost of maintenance. With the enormous train drawn it might be worth while to pay a little extra for coal, and save something in wages. He could not agree that either the American boiler or the engine was suitable for English work. There were now on the Metropolitan Railway engines with copper fire-boxes and brass tubes and boilers that had been running from 1864, an average of 30,000 miles yearly; and he did not think that any American engine could at all compare with them.

Mr. ADAMSON said that the rigid frame was not well adapted for lateral action, and was not cheap in first cost. He thought that the Americans would do well to adopt the English plate frame. It was not surprising if the Americans used more cast-iron for wheel and other purposes than was used in England, because they had a high-class charcoal iron that answered the purpose better than the ordinary English irons. He hoped that the discussion would lead to the introduction of new compounds of a better kind and at a much less cost. As far as the boiler manufacture mentioned in the paper was concerned, it was simply monstrous. As to the lap-jointed double rivet, some members would recollect a paper by Mr. Ramsbotham, twenty-five years ago, in which he referred to an explosion on the London & Northwestern Railway with a single lap-jointed longitudinal seam. He (Mr. Adamson) then stated that the cause of the guttering of the joint arose from the irregularity of the circle. If the wagon-top boiler described by the author were tested hydraulically, it would be sent into fragments. The only admissible thing was a true circle, either out of a solid ring or a butt joint riveted one or both sides.

Mr. JEREMIAH HEAD said it was important that quick-running engines should be balanced as perfectly as possible. There was no question as to the expediency of balancing revolving weights with other revolving weights, and it was quite impossible to balance reciprocating weights perfectly in any other way than by other reciprocating weights. The best attempt he had known in that direction was in Mr. Crampton's double compound engine, where there was one set of weights flying in one direction and another in another. But another way, perhaps, to render the momentum of the flying weights innocuous was to arrange a cushion of steam in the cylinder in such a way as to bring it up gradually. The author stated that he balanced half the reciprocating weights by revolving weights. No doubt when the engine was on the two horizontal centres, it minimized the strain on the axle-box guides in those positions; but how was it when the cranks were in a vertical position? Then the excess of the revolving weights over and above the others was unbalanced. There would thus be alternately a tendency to lift the wheel off the rails and to give a blow on the rails which might possibly lead to accident.

Mr. Price Williams said that he had had the opportunity of seeing the engines used in the United States, in New Zealand, Victoria, and New South Wales; and he had been furnished with details of the performances of the Baldwin type of engine as compared with the English type. The Baldwin was no doubt a rather rough type of engine, but in its economical results it had a great advantage over the more highly finished type. The latter was suited for the beautiful roads in England, but quite unadapted for the style of country in New Zealand.

Sir I. LOWTHIAN BELL said that he did not suppose that any peculiarity of the road could affect the material of which the fire-box was formed. He had been astonished to find how universally the use of steel for fire-boxes was approved in the United States, and how entirely it was condemned in this country. The question was one of first cost and of repairs, and he was surprised that English locomotive engineers had not been able to formulate with more precision than they had done the relations between those two items. America was a country that exported copper largely, and imported iron largely, and one would have thought that, under those circumstances, copper would have been the material supplied. In England precisely the reverse obtained. One advantage claimed for steel fire-boxes was their thinness, permitting the transmission of heat more quickly, in spite of the superior conductivity of copper; but, on the other hand, it was said that the consumption of fuel was much larger.

Mr. RICHES said that with regard to the staying of fire-boxes it was found in his district that the old method of the beam roof stays was not as useful a type as the radiating stays in the trailing end of the box; but in the three front rows he inserted expansion stays which had an almost unlimited expansion vertically. A great deal depended on the water that was used. Brass might be used in one locality and iron and steel in another, but no hard and fast rule could be accepted. In some cases the water was largely impregnated with carbonate of lime and sulphates, and then there was a great deal of difficulty in keeping the water spaces clear of incrustation. Transverse stays, he thought, were objectionable on several grounds. He had tried iron tubes, and had failed to get two years' life out of them in some districts where the water was bad. In the Taff Vale district iron tubes were not found useful. He had given up wood lagging for ten years. The radiation from cement lagging was infinitely less, and the heat was consequently much greater, besides doing away with the filth and dust arising from burning wood lagging. With regard to the balancing, some time ago he had some engines balanced in rather heavy blocks. The balance weights were concentrated immediately opposite the crank arms for inside cylinder engines. But for the last eight or nine years he had adopted the principle of a dispersing or diffusing weight over a longer area of the rim. Although there was a minute increase in the weight

of the balance weight, it had done away with the blow alluded to by Mr. Head, from which they used to suffer when the weights were concentrated too closely together.

Mr. JOY said he had been told by an American locomotive engineer that the consumption of coal on a locomotive running 27 miles in thirty-two minutes was 55 lbs. per mile. The same work was done on English railways at 25 lbs. per mile.

Mr. WORSDELL said that, when he was on the Pennsylvania Railroad, in 1865, copper fire-boxes were universally used; but they were in a deplorable condition, wearing out almost immediately, from the immense amount of friction of the very inferior coal that was used, the sharp blast that was required, and the wire netting placed in the chimneys. He afterward put in a large number of fire-boxes, but there was a good deal of unsatisfactory work with them. Sometimes, when the box was comparatively new, a large portion had to be taken out on account of the blistering of the plate. Steel was then used; the first was imported from England, and it seemed to harden, the process of manufacture not being perfect enough. The Americans soon began to make crucible steel. He had put in 250 steel fire-boxes on the Pennsylvania Railroad, and not one failure occurred during the time he was there, a period of six years. The water, however, was exceptionally good, carbonate of lime deposits being almost unknown. He was not prepared to say what the experience had been on lines where the water had been bad. On the Great Eastern and on the Northwestern railways they could not do with steel fire-boxes, because when there was a slight deposit the plate began to yield to the fire. With regard to the balancing and reciprocating parts, there were many things to be taken into account, especially the amount of friction. On the Pennsylvania Railroad, after the balancing, it was found that the engines ran apparently very well, but they ran very differently down hill without steam from what they did when running fast on a level with steam. The use of hollow spoke wheels filled with lead had to be abandoned. When the wheels came in for repairs it was found that the lead had knocked against them so much that they feared it would break the chamber; they therefore reverted to the old plan of casting in solid or fitting in loose weights.

Mr. CRAMPTON thought there was no necessity for weights. He got over the difficulty by duplicating his engine, having two engines instead of one; but in locomotive engines they could not afford to have one engine balancing another. He rather went in for simplicity of parts. They could do with two cylinders, and if an engine could run with one he would advocate it. If a dome was used it should not be where the Americans put it, in the spot where the greatest ebullition took place, but in a neutral portion, where the level of the water was the same under all circumstances. As to the question of consumption of coal, a convenient mode of reckoning was to take the relative consumption per mile. The American consumption was said to be very heavy, and there were several reasons for it; the engines drew heavier loads under worse conditions and wheels were smaller and the cylinders larger, so that an immense amount of steam was required. As the author had stated, the object was to get the trains moved away regardless of working the engines economically. As to the cost of production, it had been urged that railway companies should not make their own engines, because of the fads and fancies of locomotive superintendents, and the varieties of style required. The introduction of the skilled master mechanic had removed the old difficulty, so that engines were now built, not according to special types, from which no deviation was allowed, but according to the requirements of the road, which were known to the master mechanic only. With regard to the staying of the fire-box, he had found the stay at the top of the box resting upon the corner sufficiently strong and stiff, and no other fixture was required. He had used plastic lagging, but there was sometimes a slight leakage of one of the seams of the boiler, and the steam saturated the composition, and great corrosion took place at the point where the saturated material bore upon the steel plate. He consequently went back to the old wooden lagging, properly supported with longitudinal T-irons. He did not think that the cost of the cylinders mentioned in the paper was out of the way.

Mexican Indebtedness.

The Mexican *Financier* prints from the treasury department an official statement of that country's indebtedness, which is as follows:

CONVERTED DEBT.	
Debt contracted in London	$69,958,875.00
Carbajal bonds	227,375.88
Old English convention	5,836 441.10
Old Spanish convention	4,058,082.77
Old convention of Padre Moran	554,042.42
Interior debt	24,810,197.12
Total	$106,045,014.29
UNCONVERTED DEBT.	
American debt	$975,124.00
Balances of budgets which are to be converted into Treasury bonds	20,000,000.00
Subventions and contracts	24,000,000.00
Total	$44,975,124.00
Grand total	151,020,138.29

Assuming 10,000,000 inhabitants, this is a little over $15 per capita.

All Mexican securities seem advancing in price, as shown by the following table of prices in London:

	June 21, 1886.	June 2, 1887.
English debt	21⅝	32
Mexican Vera Cruz Railway first preference	87¼	131
Ordinary	27½	65
Mexican Central 4s	39⅝	69
Federal District railway shares	70	82

This is very satisfactory in the face of a sharp decline in the value of silver, Mexico's chief staple of export.

THE SCRAP HEAP.

Saturday Half Holiday in Pittsburgh.

Mr. George Westinghouse, Jr., has adopted the plan of giving all his employés a half holiday on Saturday. Also baths will be erected at the works, in Pittsburgh, and it is said a library will be fitted up for the use of the workmen.

Narrow Gauge in Servia.

The Servian government has decided to adopt the meter gauge for the new lines to be constructed. The wide gauge will be required only for two international lines—from Belgrade toward Constantinople and from Belgrade toward Salonica.

Overland Traffic from Australia.

About two years ago, George H. Hibbard went to Australia as agent for the Union Pacific, the Chicago & Northwestern, the Chicago, Rock Island & Pacific and the Chicago, Milwaukee & St. Paul roads. He was to capture for the roads named all the passenger business from the antipodes. He had great difficulties to contend against and the expense of maintaining the union office has been enormous, and the passenger travel secured next to nothing. The several roads interested have tried the Australian experiment, and on the 1st of July next Hibbard will close up the office and return to America.

Electric Lights in the Hoosac Tunnel.

The Westinghouse Electric Light Co. has a corps of men at work attempting to light the Hoosac Tunnel by electricity, an experiment that has already been tried several times without success. At least 400 incandescent lights will be required if the plan can be made practicable.

Proud as Base-ball Pitchers.

From the brusque way some railroad ticketmasters act, one would think they were superior to their station.—*Boston Gazette.*

An East-bound Shipment.

Old Timer (tendering pass to conductor)—"How are you feeling this morning, conductor?" Conductor (handing back the pass)—"I'm feeling 'fare,' thank you."—*Chicago Herald.*

An Old Friend in a New Summer Suit.

"Seen a man go along here lately?" asked a Dakota conductor, leaning off the platform as the train passed a farmer at work near the track.

"Yes."

"Red whiskered man?"

"Yes."

"Grip in each hand?"

"B'lieve so."

"When did he pass?"

"'Bout ten minutes ago—he's just around the curve. He's walkin' middling fast, though."

"That's just the trouble, but I'll catch him or run every wheel off the engine! I've no objection to his walking if he's in a hurry, but he wants to put up his fare first, and you bet he'll have to if we catch him! Hi, there, Bill, pass the fireman some more of those dry express packages!"—*Dakota Bell.*

Worse than the Guillotine.

The train was approaching Troy. "Are you going to eat your dinner at the railroad restaurant?" he asked of a passenger. "Yes," was the reply. "Just slip that card in your pocket," he whispered, "I'm an undertaker.—*Exchange.*

Capital Stock, $8,000,003.

"Two new railroads coming here, I understand," said a Dakota man to another resident of the same place.

"Yes, and there came mighty near being three."

"How's that?"

"Why, five of us organized a new company yesterday with the intention of running tracks out of this town, like spokes of the hub of a bicycle wheel, but we tried all day and couldn't raise the $3 necessary to get incorporated. We hope to make it up this afternoon. Look out for three columns in to-morrow morning's paper."—*Dakota Bell.*

The Industrial Position of Buffalo.

The following figures for the manufacturing industries of Buffalo, Cleveland and Pittsburgh in 1880, are taken from *Bradstreet's:*

	No. of establishments.	Capital, 1=1,000.	Av. No. of hands.	Wages paid.	Value of products.
Buffalo	1,183	26,847	17,991	7,442,100	42,937,701
Cleveland	1,065	19,431	21,724	8,502,935	48,604,050
Pittsburgh	1,112	52,645	30,930	17,168,989	75,915,033

It is asserted that the capital now employed in Buffalo is $50,000,000. The number of hands is 55,000 and the value of the annual product is roughly stated at $100,000,000. Over sixty different industries are enumerated, from ship and car building to stained glass and bird cages. Three concerns are engaged in iron and steel ship building, and about the first, if not the first, triple expansion engine placed in any steamer in the United States was that in the Susquehanna, built at Buffalo.

The population, which was 155,143 in 1880, is now estimated at 250,000; this is an increase of 61 per cent. The value of real and personal property has increased nearly 40 per cent., and the bonded debt but 12 per cent. The average number of houses built since 1880 has been 1,600 and of stores 400, yearly.

Buffalo has 42 square miles of yard and track area and 436 miles of track, which will be increased to 660 miles.

The receipts by lake and shipments have been:

Receipts.	1880.	1881.	1886.
Flour and grain to bushels	112,876,568	65,241,833	98,481,810
Shipments.			
Canal, grain, bushels	72,569,935	55,491,398	92,746,623
Rail, grain out of elevator, bushels	30,958,927	21,808,356	20,818,797

Lake shipments of heavy merchandise were:

	1886.	1881.	1880.
Coal, tons	1,562,050	825,240	589,670
Cement and plaster, barrels	378,960	170,410	114,125
Salt, barrels	126,040	109,810	225,982
Salt, tons	2,635	11,635	17,725
Railroad iron, tons	45,894	44,462	35,941
" " bars		23,100	21,084

The coal pockets can handle 16,000 tons daily, and have a storage capacity of 24,000 tons.

A steady increase in the lumber and live stock trades is reported.

French Railroad Restaurants.

The French state railroads, following the example of several private companies, have established a meal at a fixed price in their restaurants. They give a plate of meat and vegetables, cheese, a pint of wine, and bread, for 30 cents.

Precocious Fort Worth.

On July 18, 1876, the first railroad entered Fort Worth, Tex. As I write, the seventh railroad, stretching away to the southwest, is being finished. When the first road entered, the total valuation of property in the city was $250,000. To-day it is about $6,000,000, an increase of 2,400 per cent. in a little over a decade.—*St. Louis Republican.*

Private Owners' Cars in England.

In 1882 much interest was excited in commercial circles, particularly among wagon and coal companies, by the new policy of the Midland Railway Company acquiring the private wagons. This policy has been very vigorously pursued, with the result that the letters "M. R." meet the eye at almost every turn when the traveler is on the rails. The circular issued by the Midland Company to the traders upon their line was dated Feb. 13, 1882, and it is interesting to know that up to May 24, 1887, the number of wagons thus bought reaches the enormous total of 47,000.—*The (London) Engineer.*

Employes' Holiday in England.

The directors of the Midland Railway have decided to give all the men in their employ a day's holiday on June 21, allowing them a day's pay therefor, in commemoration of the Queen's Jubilee. This will apply to the men all over the line, and those who cannot be spared on the 21st will have another day.

"At my expense, but you pay for it," does not seem to be so popular a rule on the Midland as it is in some other parts of the world.

TECHNICAL.

Locomotive Building.

The Old Colony is building at its South Boston shops 3 17 × 24 passenger engines and has nearly completed another large consolidation engine of the same type as No. 132, illustrated in the *Railroad Gazette* Feb. 25, 1887. The tender which was originally built for No. 132 was inadequate and another has been constructed to take its place on the Fall River boat train. The new tender will carry 3,545 gallons of water and 8,000 pounds of coal, thus making it unnecessary to stop for water between Boston and Fall River.

This road has just received from the Taunton Locomotive Manufacturing Co. a heavy switching engine, cylinders 17 × 24, with six drivers, and weighing with tender loaded 133,540 lbs. Another of the same pattern and build will be delivered in a few days.

The Boston & Lowell road is building at its shops, in Concord, N. H., two 17×24 switching engines.

The Hinkley Locomotive Works have recently sold to the Denver, Memphis & Atlantic road three 18×24 passenger engines. The works are at present running to their full capacity, and have orders ahead for three months.

The Car Shops.

The Philadelphia & Reading has contracted with the Harrisburg Car Co. for the construction of 2,000 coal cars, at a cost of about $900,000. It will take eight months to fill the order.

The Louisville, New Albany & Chicago has placed an order for 250 box cars with the Lafayette car works. Saturday the Monon road sent south from Lafayette, Ind., thirty-five trains. This road is doing an immense business just now.

Twelve new first-class cars have just been finished for the Fitchburg at the Charlestown shops, and 15 more of the same have been ordered; also 3 baggage cars and 100 gondola cars.

The Pullman Palace Car Co. has placed an order with their construction department for two of the most improved buffet cars, with twelve sections, drawing-room, smoking-room, etc., to be run on the Chicago & Alton's St. Louis & Kansas City line.

Bridge Notes.

The St. Louis Bridge Construction Co. was the successful bidder for the erection of the six iron bridges to be built at McPherson, Kan. When the bids were opened by the county commissioners fourteen bridge contractors were in attendance.

The Secretary of War has approved the plans for a new bridge over Cumberland River at Nashville. The estimated cost is $100,000. The contract for the superstructure has been given to the Mt. Vernon, O., Bridge Company for substructure, and embankments to John Broderick, of Nashville. E. F. Falconet, of Nashville, is engineer in charge.

Iron and Steel.

The Freeport Improvement Association has purchased the old Model Refining Works from the Standard Oil Co. at Butler Junction and donated it to Farrelly, Alden & Co., who intend to begin building, at once, at Freeport, Pa., a large iron mill for the manufacturing of sheet iron. The company is to be known as the firm of William H. Rodgers & Co.

George H. Hull & Co., of Louisville, Ky., announce that their new business has been divided into two departments, with Alfred Kellond, late of the Louisville & Nashville Railroad, in charge of the pig iron business, and H. D. Lafferty in charge of the coal, coke and fire brick business.

The Crozier Iron & Steel Co. has made an assignment for the benefit of its creditors. The preferred creditors amount to $378,000, and the assignment was made, it is stated, for the adjustment of some legal difficulties, among which is a claim of $80,000. The works are located at Roanoke, Va., and the principal owner is Samuel A. Crozier, of the Chester Rolling Mills, Pennsylvania.

The Tudor Iron Co., has been awarded the contract for the bolts and spikes for twenty-five miles of Texas extension of the St. Louis, Arkansas & Texas Railroad.

Manufacturing and Business.

The Pond Machine Tool Co., the largest concern in its line of business in Worcester, Mass., is to remove to Plainfield, N. J. It employs 600 hands, most of whom will go with it.

The Stewart Heater Co., Buffalo, N. Y., is about to begin the erection of new works at Kensington Station, Buffalo, a new addition to the northeast part of the city. A plot of land 200 ft. square has been donated to them in case they will put up suitable works. The proposed shop will be 40 by 80 ft., three stories high.

The Pittsfield Electric Illuminating Co., of Pittsfield, Mass., are changing their plant from the old direct current system to the Westinghouse alternating system. Their first installment is for 1,300 lights, and they have received the contract for the city lighting for the ensuing year.

The Southern Cotton Oil Co. has awarded its boiler contracts to the Abendroth & Root Manufacturing Co., and its engines to the Westinghouse Machine Co. This contract comprises 60 engines, aggregating 3,380 horse-power.

The Walker Manufacturing Co., Cleveland, Ohio, has just contracted to furnish $30,000 worth of machinery for the equipment of the new cable road in Kansas City, Mo.

Edward Kendall & Sons (formerly Kendall & Roberts) engine builders, Cambridgeport, Mass., have under construction two heavy special railroad pile drivers with double drum. They are for track use, self propelling and will be operated backward and forward by link motion. When completed one will be used on the Gulf, Colorado & Santa Fe, and the other on another large western road. This firm has shipped during the past 15 days 12 heavy mining engines to the Rocky Mountain district and have orders sufficient to keep them busy for two months.

The Betts Machine Co., Wilmington, Del., have just shipped to the Holly Manufacturing Co., Lockport, N. Y., one of their heavy pattern 10-ft. planers. This machine will plane 10 ft. square and 16 ft. long; it has two tools on the cross rail, and one on each upright, four in all. It is made with three V's and double rack, and is very powerfully geared. Weight, 102,000 lbs. This is the thirteenth of these large machines the Betts Co. has sent out—four to Pittsburgh, Pa.; two to Reading, Pa.; two to Lockport, N. Y.; one to Alliance, O.; one to Chester, Pa.; one to New Castle, Pa.; one to Newark, N. J., and one to Wilmington, Del.

In November of last year the Industrial Works, of Bay City, Mich., began building capacious erecting and wood working shops as an addition to their plant, consisting of machine, blacksmith and foundry departments, as well as a galvanizing branch for local work. With this increase in their capacity, they have still found difficulty in keeping up with their orders. Their contracts this season in some instances covering a complete line in their specialties, embrace among others the following roads: Union Pacific, Atchison, Topeka & Santa Fe., New York Central & Hudson River, Chicago, Santa Fe & California, Michigan Central, Atlantic & Pacific, Chicago, Burlington & Quincy, St. Louis & San Francisco, Denver & Rio Grande, Chicago, Kansas & Nebraska, Chicago & Northwestern, Chicago, Rock Island & Pacific, Milwaukee, Lake Shore & Western, New York, Providence & Boston, Chicago, Burlington & Northern, Detroit, Bay City & Alpena, Hannibal & St. Joseph.

The Rail Market.

Steel Rails.—Early in the week there was a sale of 10,000 tons of foreign rails to a Southwestern road, and a lot of 5,000 tons by an Eastern mill. The Norfolk & Western contract for 15,000 tons has been placed with a Pennsylvania mill. A lot of 15,000 tons of foreign rails was placed for Portland, Oregon, delivery, at about $45. Quotations, $38@$39 at Eastern mill.

Old Rails.—No business reported. Quotations, $21@$21.25 for tees and $21.50@$21.75 for double heads. About 1,500 tons of a special French make was sold for Philadelphia delivery at $23.

Scrap.—Market very dull. Yard scrap is quoted nominally $21@$22.

Rail Fastenings.—Spikes, 2.40@2.50c. net; angle fish bars, 2.15@2.25c.; steel angle bars, $2.25@$2.30; bolts and nuts, 3.10@3.20c.; and bolts and hexagon nuts, 3.25@3.30c.

Simplon Tunnel.

The Italian Government has decided not to grant a subvention to the work of tunneling the Simplon, which may, it is said, have the effect of causing the project to be abandoned. —*The Engineer.*

Engineers' Club of Kansas City.

The regular monthly meeting of the Engineers' Club of Kansas City was held June 6. A letter was read from Prof. John Eisenmann, soliciting the co-operation of the club in the matter of National Public Works. Action in regard to it was deferred. Mr. A. J. Mason read a paper on railroad engineering in Australia, which was discussed. The paper treated of the characteristic features of the country and their influence, as well as that of the Government, on the location and construction of railroad lines, and also of the opening for American engineers. The next regular meeting of the club will be devoted to the discussion of the twenty-four hour system. A paper from Mr. H. C. Pearson will be read.

American Institute of Mining Engineers.

The forty-eighth meeting of the Institute will be held in Utah and Montana, beginning at Salt Lake City on Wednesday evening, July 6. Members, associates and friends going from the East will leave Chicago for Denver by the Chicago, Burlington & Quincy Railroad on Friday, July 1, at 12:30 p. m.; Chicago headquarters, the Sherman House; arrive at Denver Sunday morning, July 3; leave Denver Monday morning, July 4; arrive at Pueblo same day; leave Pueblo Tuesday afternoon, July 5 (reach Grand Cañon of the Arkansas about 3 p. m); arrive at Salt Lake City, Wednesday, July 6; leave Salt Lake City Monday evening, July 11; arrive at Butte City, Tuesday, July 12; sessions and excursions in and about Butte City on Tuesday, Wednesday, Thursday and Friday; leave Helena Saturday morning, July 16; arrive at Mammoth Hot Springs same evening; spend Sunday at Mammoth Hot Springs; Monday, Tuesday, Wednesday and Thursday, visits to the Geyser basins, Yellowstone Cañon and Falls, etc., in the National Park; leave the Park Friday, July 22; arrive at Duluth, Sunday, July 24.

The detailed programmes of sessions, etc., at Salt Lake and Butte will be arranged by the local committees at those places. Letters of inquiry on these subjects may be addressed to Mr. Joseph A. Walker, Salt Lake City, or Mr. C. W. Goodale, Butte, Montana.

The forty-ninth meeting of the Institute will be held at Duluth, Minn., beginning Tuesday evening, July 26. The detailed programme of this meeting will be either communicated in a later circular from this office, or handed to members on their arrival at Duluth. At present, it can only be said that there will be, besides the hospitalities and pleasures of Duluth and its harbor, excursions to the Vermilion and Gogebic mines. Letters concerning this meeting may be addressed to Mr. R. S. Munger, Duluth, Minn.

The Strong Locomotive.

The Strong locomotive, No. 444, has gone to St. Paul, that the master mechanics may have a chance to examine it during their convention. It left Jersey City Saturday night, hauling the 9 p. m. express train, containing 15 cars, to Philadelphia, and left Philadelphia at 11.50 a. m. Sunday, pulling the heavy No. 1 train of the Pennsylvania, and remained a day at Altoona, and then made the run over the mountains by daylight with one of the express trains, carrying some of the Pennsylvania officers. It ran to Chicago over the Fort Wayne route, and from Chicago to St. Paul over the Chicago, Milwaukee & St. Paul.

Appropriation for the Sault Ste. Marie Canal.

In the Canadian Parliament June 7, an appropriation of $1,000,000 for the new Sault Ste. Marie Canal was passed without opposition. Sir Charles Tupper stated that it was not anticipated that the whole of this amount would be required to complete the work. The canal is to be of similar dimensions with that on the Michigan side of the river.

American Society of Civil Engineers.

The annual convention for the year 1887 will begin at New York City, July 1, 1877. Members who can conveniently do so are invited to meet informally at the Society House, 127 East 23d street, New York, on Thursday evening, June 30. On Friday morning, July 1, a steamer of the Albany Day Line will be taken at the foot of West 22d street, New York. The party will proceed by steamer to Rondout, and thence by the Ulster & Delaware, the Stony Clove & Catskill Mountain and the Kaaterskill roads to the Hotel Kaaterskill, Catskill Mountains, N. Y.

Those who find it impracticable to join the party on the morning of July 1 can proceed from New York either by rail direct, or via the Hudson River to the Hotel Kaaterskill at any time.

Members of the Society are particularly invited to transmit to the Secretary papers they are willing to present at this Convention, in order that a place may be given them in the programme. The families of members are invited to accompany them to the Convention.

Sessions of the Convention for professional discussions, and one for the transaction of business will be held. An excursion will be made during the week beginning July 3, to visit on invitation of the Union Bridge Co., the Poughkeepsie Bridge and the City of Poughkeepsie. An excursion will also be made to the cement works and quarries of the Rosendale cement rock at Binnewater, on invitation of Mr. F. O. Norton, F. Am. Soc. C. E. The Fourth of July will be spent at the Hotel Kaaterskill, where, in the evening there will be fireworks and a ball. On the evening of one of the other days of the Convention there will be a banquet. The president of the Society, William E. Worthen, Esq., will deliver the annual address at one of the sessions of the Convention. The arrangements made by the Committee provide for return to New York on Friday, July 8.

The rate at the hotel will be $3 per day.

The arrangement for special fares has been made with the Trunk Line Association Passenger Committee and with the Central Traffic Association Passenger Department, each for the lines composing such association. Full fare must be paid *to* New York by each person attending the Convention. A return ticket will be sold *at* New York at *one-third fare* to persons holding the required certificate, properly indorsed by the Secretary at the Convention.

At the regular meeting, June 16, the evening was occupied by M. Boulanger, a French engineer, who has lately returned from Panama, and who gave some account of the condition of work on the canal. His conclusions were most discouraging for the future of the project.

The Coke Strike Ended.

The coke drawers in the Connellsville district, who have been idle since the first of May, returned to work this week, an advance of 12½ per cent. wages being granted by the H. C. Frick Coke Co. which supplies the Carnegie steel interests. It is said the result was brought about by a cablegram from Andrew Carnegie in Scotland to Henry Phipps, of the firm of Carnegie Bros. & Co.

An Electric Torpedo.

An electric torpedo for use as an auxiliary to fixed danger signals has been introduced in France. The wheel of the locomotive acts upon a pedal, and through a commutator reverses an electric current, which liberates a weight, the fall of which explodes the torpedo; the weight in falling also uncovers a signal disc or a green or red light. By means of electric communication with a signal station, the operator can arrange to prevent the explosion of the torpedo, if the conditions are such that that is not necessary or desirable.

A Drainage Canal in Mexico.

Capitalists of Cleveland, O., have secured a contract with the Mexican government for the construction of canals to drain the valley of the City of Mexico. The contract calls for the expenditure of $1,000,000. A canal will be constructed around the city connecting the lakes and draining the valley. The work must be done by native laborers, but American superintendents will be employed. Work will be begun Aug. 1. The canal is part of a vast system of draining to be undertaken by the Mexican government, costing five or six million dollars. A tunnel through the mountains surrounding the valley of Mexico is an essential part of the face of Lake Tuscuco, and being completely surrounded by plan, the city lying not more than 6 ft. higher than the surthe mountains.

The Baltic Canal.

On June 2 the German Emperor inaugurated the canal which is to connect the German Ocean with the Baltic.

The proposed dimensions are: length, 61 miles; width at water line, 167 ft. and 85¼ ft. at the bottom; depth, 27½ ft., giving a normal water cross section of 3,934 ft., equal to six times the cross section of the mercantile steamers likely to use it, and a width which will admit their passing.

The saving of distance compared with the route by the "Sound" is computed at 237 miles.

Trans-Caspian Affairs.

The Imperial Commission, under the direction of General Paucker, deputed to take over the Trans-Caspian Railway, report the construction of the line perfect. The commission has inspected the ruined dam on the Murghab and recommend its immediate restoration, by which the Merv oasis will gain an area of about 1,500,000 acres suitable for the production of cotton. The Russians are now extending the Merv Railway and telegraph lines in a southerly direction toward Penjdeh.—*Herapath's.*

Mexican Railroads.

Mr. Louis Huller has received a concession for the following lines of railroad:

1. From Tijuna, on the border between California and Lower California, through Lower California to Los Angeles.
2. From Tijuna to Puerto Isabel, on the Rio Colorado.
3. From Puerto Isabel, through Altar, to Magdelena, on the Sonora road.
4. From Magdalena to El Paso del Norte.

This concession, which is for 99 years, and carries the right to construct telegraph and telephone lines for the use of the road, requires the commencement of construction within one year from its date, and that lines 1 and 2 shall be finished within twelve years, and that lines 3 and 4, the building of which are optional, shall be completed, if undertaken, within seventeen years. Rails and rolling stock may be imported free of duty.

Activity in the Iron Trade.

The New York *Tribune* printed the following dispatch from Philadelphia, dated June 12: An extraordinary activity in the demand for steel rails has developed in this market. The transactions since June 1 up to date are reported at 140,000 tons, and the inquiries being made, it is declared, will be sufficient to absorb the output of the mills. The sales for the year up to date are reported at 1,700,000 tons.

A better feeling is reported among the iron manufacturers, especially the pig iron makers.

The locomotive builders report that the demand for locomotives keeps up remarkably well. The Pennsylvania Railroad Co. is building sixty, the Reading twenty-five, and the Baldwin Locomotive Works are running day and night upon orders.

The Meeting of the Iron and Steel Institute of Great Britain.

The papers reported of interest were Mr. Potter's description of the South Chicago Iron and Steel Works, and Mr. Riley's investigations as to the effects of different methods of treatment of mild steel in the manufacture of plates.

Mr. Potter's paper and its discussion brought out the facts that in this country furnaces, by hard blowing, make 150,000 tons of pig iron in 2¼ years, when they require relining at a cost of $15,000, or 10 cents per ton, and 60 days' loss of time; and in England a furnace of the same capacity will make 45,000 tons per year for 7½ years, and then require 6 months to reline, or, in other words, two American furnaces do the work of three English. Sir Lowthian Bell thought English furnaces endured 12 to 14 years, said that at the Edgar Thomson Works they produced 1,700 tons a week with a consumption of 19 cwts. of coke, which was better than could be done in Cleveland, where, if they exceeded 500 to 530 tons of iron per week, the quality falls, an effect not produced in the United States.

At a subsequent meeting Sir Lowthian stated that the consumption of manufactured iron per head of population was in the United Kingdom 290 lbs. and in the United States 270 lbs. The 399,000,000 people in the United States and Europe consume on the average 107 lbs., and the average consumption of the 1,425 million inhabitants of the world is asserted to be 23 lbs. per capita, 517 million using only ½ lb. each per year.

The conclusions arrived at by Mr. Riley were: First, as to reheating *vs.* soaking. The balance of advantages is slightly in favor of the soaked ingot. Second, cogging *vs.* hammering. No practical difference in the results. Third, cross rolling *vs.* rolling with the length of the ingot. Though there is a clear advantage in the former, it is not as great as might have been anticipated. Tests taken lengthwise of the plates are about the same in both instances, but in those taken crosswise, though the strength is practically equal in both cases, yet the ductility is decidedly in favor of the cross rolled plates. Fourthly, as to the effect of "work" put on the steel in the production of the plates, the author says:

The teaching seems to be that if you want a strong steel, without caring greatly about its ductility, put abundance of work upon it; but if you desire a plate of medium strength and of high ductility, do not put an excessive amount of work in it; and if you would increase the ductility, anneal it carefully after rolling. Experiments were made showing the injury done by shearing, punching, etc., especially when machines are not kept in proper order.

The necessity for annealing was emphasized in all cases where plates are distorted while subject to only partial heating.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Cincinnati, Hamilton & Dayton, annual meeting, Cincinnati, O., June 21.

Fort Worth & Denver City, special meeting, Fort Worth, Tex., June 22.

Oregon Railway & Navigation Co., annual meeting, Portland, Oregon, June 20.

St. Paul & Duluth, annual meeting, at the office, St. Paul, Minn., June 20.

Illinois Central, meeting, Chicago, June 17.

Dividends.

Dividends on the capital stocks of railroad companies hav been declared as follows:

Chicago & Northwestern, 1¾ per cent. preferred stock 3 per cent. on common stock, payable June 25.

New York, New Haven & Hartford, 2½ per cent. quarterly, payable July 1.

Northern Central, 4 per cent., semi-annual, payable July 15, to stockholders of record June 30.

Richmond & West Point Terminal, 2½ per cent., semi annual on preferred stock.

Richmond & Danville, 3 per cent., semi-annual.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Master Car-Builders' Association* holds its annual convention at Minneapolis, Minn., June 14.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 15 Washington street, Chicago, at 7:30 p. m., on the first Tuesday of each month.

The *American Society of Civil Engineers* holds its annual convention at the Hotel Kaaterskill, Hudson River, N. Y., the first week of July.

The *American Railway Master Mechanics' Association* holds its annual convention in St. Paul, Minn., June 21.

The *American Association of Train Dispatchers* holds its annual convention in Boston on June 16.

The *Traveling Passenger Agents' Association* holds its annual convention at Old Point Comfort Va., on June 14.

The *Southern Railway & Steamship Association*, thirteenth annual convention, Atlanta, Ga., July 13.

The *American Institute of Mining Engineers*, forty-eighth meeting, Salt Lake City, Utah, July 6; forty-ninth meeting, Duluth, Minn., July 26.

Passenger Agents' Convention.

The Passenger Agents, now in Convention at Fortress Monroe, Va., have elected Charles Harman, of Atlanta, President; Frederick Bush, of Atlanta, Vice-President; H. C. Holabird, of Cincinnati, Secretary, and J. A. Quinlan, Treasurer.

PERSONAL.

—B. W. Wrenn has resigned the position of General Passenger Agent of the East Tennessee, Virginia & Georgia.

—Daniel Seymour, an American engineer, shot and killed himself on the dredge City of New York, at work on the Panama Canal, on May 28.

—H. V. Conrad, formerly in the mechanical department o the West Shore, has been appointed Superintendent of the Hinkley Locomotive Works of Boston.

—Seymour L. Husted, President of the Brooklyn City Railroad, which is said to be the largest street railroad in the world, died in Brooklyn, N. Y., on June 13.

—John Whittle, Assistant General Freight Agent of the Lehigh Valley, died of heart disease in San Francisco on June 9. He was on a pleasure trip with other officials of the road.

—W. P. Johnson, Western Passenger Agent of the Lake Shore & Michigan Southern, has sent in his resignation. For 25 years he was with the Illinois Central, resigning the position of General Passenger Agent of that company about 7 years ago to take a similar position with the Lake Shore. He was General Passenger Agent until March 1 last, when he became Western Passenger Agent, as the general office was removed to Cleveland.

ELECTIONS AND APPOINTMENTS.

Atlanta, Knoxville & Northwestern.—The incorporators of this Tennessee company are: Alexander A. Arthur, M. L. Ross, and W. R. Tuttle, of Knoxville, Tenn.; George B. Eager and R. M. Pulsifer, of Boston, and James V. Jackson, of Augusta, Ga.

Arizona Mineral Belt.—The following officers have been elected: J. W. Eddy, President; A. A. McDonnell, Vice-President; P. Shaw, Treasurer, and George White, Secretary.

Atchison, Topeka & Santa Fe.—F. C. Gay has been appointed Assistant General Freight Agent, with headquarters at Kansas City, Mo.

Bangor & Portland.—The following officers and directors have been elected: President, C. Miller; Vice-President, D. C. Blair; Secretary, George W. Mackey; Treasurer, John I. Miller; Registrar of Stock, A. M. Paff: Directors, C. Miller, D. C. Blair, George W. Mackey, John I. Miller, Dr. J. Buzzard, Jonathan Moore, J. E. Long, Joseph Bray, John L. Blair.

Boston, Hartford & Erie.—The following directors were elected at a recent meeting: John Rooney, Richard A. Roberts, Park A. Williams, Delorme Knowlton, A. B. Patten, Henry R. Hilton, Col. James A Clark, Wm. M. Denman and M. A. Coleman.

California Central.—The officers of this new consolidated company are: George O. Manchester, President; C. W. Smith, Vice-President; Herman Silver, Secretary, Treasurer and Auditor; George Goodwin, Assistant Secretary and Treasurer; John P. Whitehead, Comptroller, and F. T. Perris, Chief Engineer.

Chicago & Western Indiana.—Of this road, and the Belt Railway of Chicago, the following directors have been elected: John B. Carson, Louisville, New Albany & Chicago; O. S. Lyford, Chicago & Eastern Illinois; W. J. Spicer, Chicago & Grand Trunk; F. Broughton, Chicago & At-

lantic; A. A. Tallmage, Wabash, Western, and C. W. Smith, Atchison, Topeka & Santa Fe.

Chicago, Burlington & Northern.—The annual election resulted in the re-election of A. E. Touzalin as President and the old board of directors with few changes.

Chicago, Rock Island & Pacific.—George L. Chatfield has been appointed Assistant General Master Mechanic, with headquarters at Chicago.

Clay Centre, Minneapolis, Kanapolis & Western.—The directors are: John Triplett, Minneapolis; James W. Snyder, Kanapolis; Adolph Gilbert, L. D. Moore, Henry Morgan and John Campbell, of Minneapolis, and G. M. Stratton, of Clay Centre, Kan.

Cortez & Dolores.—The officers of this new Colorado company are: Burtis L. Arbecom, of Boston, Mass., President; James W. Hanna, of Cortez, La Plata County, Col., Vice-President; Humphrey B. Chamberlin, of Denver, Col.; Emory S. Turner, of Newburgh, N. Y., Secretary and Treasurer; John P. Heisler, of Denver.

Cumberland & Piedmont.—The recent elections resulted as follows: President, Thomas B. Davis; Secretary and Treasurer, H. G. Buxton; directors, T. B. Davis, H. G. Davis, S. B. Elkins, J. A. Millholland, W. E. Porter, J. C. Brady and F. M. Offutt.

Fort Worth & Rio Grande.—Captain B. B. Paddock has been elected President and E. F. Hollis Secretary.

Garden City, Dighton & Southern.—The directors of this new Kansas Company are: C. E. Merriam, Walter W. Cleary, G. D. Orner, I. R. Holmes, Milton Brown, J. A. Weeks, C. J. Gavin, Garden City; L. H. Mallory, Winfield; C. E. Sobdell, Wm. Barnard, Col. Prouty, Dighton, Kan.

Georgia Southern & Florida.—The following directors have been elected: V. Henry Rothschild, A. Bocker, New York; Robert Ober, Baltimore; M. Nussbaum, J. H. Campbell, Sol Waxelbaum, H. L. Jewett, R. F. Lawton, G. F. Gustin, H. J. Lamar, Jeff Lane, W. B. Sparks, of Macon; E. B. Waters, Marshallville.

Hope & Shreveport.—The directors of this new Arkansas company are J. T. West, Washington; I. Foster, S. W. Brunbridge, C. T. Short, Patrick Donnelly, F.M. Thompson and Ed. Alexander.

Leroy & Carey Valley.—The directors of this new Kansas company are: T. J. Hudson, of Fredonia; J. J. Crouse, Sedan; L. C. Wait, Elgin, Kan.; Geo. J. Gould, A. H. Calef, New York; Geo. C. Smith and E. G. Merrian, St. Louis.

Mason City & Fort Dodge.—W. J. McMillan is appointed Roadmaster vice J. A. Crippen, resigned. J. A. Ross is appointed Master of Bridges and Buildings.

Master Car-Builders' Association.—At the annual meeting in Minneapolis, on June 15, the Master Car-Builders' Association elected officers, as follows: President, William Wood, Grand Trunk, Montreal; Vice-Presidents, J. W. Cloud, New York, Lake Erie & Western, Buffalo; E. W. Grieves, Baltimore & Ohio, Baltimore; John S. Lentz, Pennsylvania & New York Canal & Railroad Co., Packerton, Pa.; Treasurer, John Kirby, Lake Shore & Michigan Southern, Cleveland. Executive Committee, Joseph Wood, Pennsylvania Company, Fort Wayne, Ind.; R. D. Wade, Richmond & Danville, Richmond; F. A. Bissell, New York Central & Hudson River, Buffalo.

Milwaukee & Northern.—The following directors were elected at the annual meeting this week: Alfred M. Hoyt and Samuel A. Hoyt, New York; Angus Smith, James C. Spencer, Guido Pfister, Ephraim Mariner and Charles Ray, Milwaukee. Alfred M. Hoyt was re-elected President and James C. Spencer, Vice-President.

Minnesota & Northwestern.—George C. McMichael has been appointed Superintendent of the Des Moines Division, running from Oelwein to Des Moines, Ia.

Minnesota & Southwestern.—The incorporators of this new Minnesota company are: James M. Paine, E. M. Wilson, Horace P. Breed, Frank W. Booth, Minneapolis; Asa Paine, Northern Pacific Junction; Mark Paine and A. M. Miller, Duluth; M. J. Clark, Grand Rapids, Mich. The first officers are: James M. Paine, President; E. Wilson, Vice-President: Mark Paine, Treasurer; Frank W. Booth, Secretary; Asa Paine, General Superintendent.

Mobile & Birmingham.—Peyton Randolph has been appointed Assistant General Manager, office at Washington, D. C. C. H. Hudson is appointed General Superintendent, office at Knoxville, Tenn.

Newton, Attica & El Paso.—The directors of this new Kansas Company are: W. E. Campbell, Dr. A. Cloud, Kiowa; J. W. Wilson, Canfield; B. Brown, John M. Miller, Joseph G. Wilson, Dr. S. C. Bell, Attica; E. B. Beck, Hazelton; Charles Manning, Spivey, Kan.

New London Northern.—J. A. Southard has been appointed General Freight Agent, with headquarters in New London, Conn.

New York, Lake Erie & Western.—D. H. Blackham has been made Chief Clerk in the offie of General Superintendent Thomas at Jersey City. J. H. McEwen has been appointed Chief Train Dispatcher on the Western Division.

Norfolk & Western.—J. C. Rawn has been appointed Engineer, in charge of the Clinch Valley Division, the new line of this company now building from Graham, Va., to a connection with the Louisville & Nashville. C. M. Cook has been appointed Engineer of Maintenance of Way of the Norfolk & Western, office at Roanoke, Va.

Northern Pacific.—C. P. Cole is appointed Superintendent of the Cascade Division and of the Pacific Division and branches, with headquarters at Tacoma, Wash. Ter., vice Otis Sprague, resigned. C. S. Prowell is appointed Assistant Superintendent of Cascade Division, with jurisdiction between Pasco Junction and South Prairie Junction, Wash. Ter., headquarters at Ellensburg.

A. M. Miller has been appointed Master Mechanic of the Cascade Division, with headquarters at the Ellensbury shops.

Philadelphia & Reading.—H. J. Small, late of the Northern Pacific, has been appointed Assistant Superintendent of Motive Power, with office at Reading.

Rich Hill, Arkansas City & El Paso.—The directors of this new Kansas company are: George H. Requa, George Entzminger, E. T. Holeman, W. B. Webster and Thomas Bettes.

Rochester & Genesee Valley.—The following officers have been elected: President, James Brackett; Vice-President, Daniel W. Powers; Secretary and Treasurer, James B. Perkins.

Southern Pacific.—W. G. Van Vleck has been appointed Superintendent of the Louisiana Division, headquarters at Houston, Tex. John McQueeny has been promoted from the office of Chief Dispatcher to that of Superintendent of the San Antonio Division, headquarters at San Antonio.

Texas & Pacific.—J. G. Piersol has been appointed Division Superintendent at Marshall, Tex., in place of J. H. Redmon, resigned.

Toledo, St. Louis & Kansas City.—The directors are: J. M. Quigley, J. W. White, W. D. Hobbs, R. G. Ingersoll, H. J. Boardman, F. L. Geddes, J. C. Havemeyer, Clarence Brown, H. A. Neal, William Patton, Joseph S. Stout, Clinton W. Sweet and Charles F. Tag.

Wabash Western.—F. W. Palmer has been appointed General Agent at Chicago, with charge of through traffic between Chicago and Detroit.

OLD AND NEW ROADS.

Aberdeen, Bismarck & Northwestern.—The contract for grading this road from Napoleon, Logan County, Dak., to Bismarck, 57 miles, has been let to A. K. Beal, Thomas Fortune and Nathaniel Skelton, of Bismarck. Work between Aberdeen and Bismarck is now about half done.

Atchison, Topeka & Santa Fe.—The land for which this company has begun condemnation suits in Chicago extends from the Desplaines River near the intersection of the county line to the lake front near 16th street.

It is reported that the company has bought land in St. Joseph, Mo., for the establishment of shops, yards, freight houses, etc. The shops are to be removed from Atchison to St. Joseph. This is the second locality that has been selected (by the newspapers at least) for the site of an immense industrial village.

Atlanta, Knoxville & Northwestern.—A charter has been filed in Tennessee. A road is to be built from Atlanta, Ga., to Knoxville, Tenn., and from Knoxville to a connection with the extension of the Louisville & Nashville and Norfolk & Western roads at or near Cumberland Gap. Grading will be begun within a few weeks.

Atlanta & Hawkinsville.—The grading of this road between Atlanta and Fayetteville, Ga., will be completed in about a week. In two months it will probably be finished to Zebulon. Three thousand tons of steel rails have been purchased, two-thirds of which will be delivered this month.

Atlantic & Pacific.—Suit has been instituted by the Railroad Commissioners of California to compel this company to issue an annual report. The finance committee of the directors now has the question of publishing a report under consideration.

Birmingham, Mobile & Navy Cove.—This company proposes to build a road from Mobile, Ala., across to the eastern shore of the bay, and thence south along the shore to Navy Cove, a deep water harbor in the lower bay. The officers of the company will be elected on June 16.

Boston, Hartford & Erie.—Suit has been brought in the New York Supreme Court against the New York & New England and others, to recover the property belonging to the Boston, Hartford & Erie in the state of New York.

Boston, Revere Beach & Lynn.—The branch of what was formerly the Boston, Winthrop & Shore road, which this company has been building through the centre of the town of Winthrop, Mass., is completed, and will be open for traffic June 20.

Buffalo, Rochester & Pittsburgh.—Referee Ledyard has filed his report in the case of the United Trust Co. against this road. He finds that the sum of $3,190,784 is due the plaintiff upon mortgage bonds of the railroad amounting to $2,800,000 held by the Trust Company, and which were defaulted May 1, 1883, with interest. Before the Referee the Treasurer of the road testified that to sever from the system any of its branches or links would affect the system disastrously; and that, if sold under the mortgages, the three mortgaged lines—the Olean & Salamanca, the Oil City & Shenango, and the Genesee Valley Terminal—ought to go together.

Buffalo, New York & Philadelphia.—Three motions were made this week for judgment of foreclosure of mortgages and sale against this company and all were granted. The first was the consolidated mortgage bonds for $7,000,000, and Sussex R. Davis, of Philadelphia, was appointed referee to sell. The sale takes place Sept. 15, at Pittsburgh. The next was the collateral mortgage bonds of $28,600, for which sale Charles P. Norton was appointed referee, and the third was the first mortgage bonds of $7,000,000. Wm. L. March was appointed referee for this sale.

Buffalo, Rochester & Pittsburgh.—At the special meeting last week the proposition to increase the capital stock of the company $1,000,000, to increase the facilities and buy the rights of the preferred stockholders to dividends ahead of the common stock was passed without opposition. The preferred stockholders get 1½ shares of common stock for each share of preferred, but until the company obtains the right to issue the stock the bonds will be represented by certificates of indebtedness, entitled to dividends the same as common stock.

California Central.—Articles of agreement have been filed in California for the consolidation of the Riverside, Santa Ana & Los Angeles, San Bernardino & Los Angeles, San Bernardino Valley, San Jacinto, Los Angeles & San Gabriel Valley, Los Angeles & Santa Monica, San Bernardino & San Diego and the San Diego Central railroad companies. The consolidation is to last for 50 years, and the principal place of business to be San Bernardino, Cal. The amount of capital stock, based upon the aggregate of the capital stock of all the companies, is $8,700,000, divided into 87,000 shares of $100 each.

Canadian Pacific.—There are 4,000 men at work grading the extension from Algoma to Sault Ste. Marie. There are 87 miles, and the company will lay the tracks after the contractors finish the grading. It is not thought that trains will be running over the line before December.

Central Massachusetts.—The first passenger train from Boston to Ware, Mass., will be run on June 27, and three passenger trains between the points will be run regularly thereafter. The distance from Ware to Boston by the new road will be about 72 miles and the fare will be $1.50.

Chatham & Harwich.—The work of excavation and grading is in progress under Contractor Flinn, of South Berwick, Me. About 150 men are employed, and 50 teams are used at the present time. The contract calls for completion of the entire road by Oct. 1. It is understood that the Old Colony will equip and operate the road. It is seven miles long.

Chicago & Northwestern.—This company's new line from Chicago to Sioux City, Ia., was opened on June 12. The distance is shortened by 25 miles. Under the new arrangement, double daily trains will be run, making the trip in about 21½ hours. One of the trains has through sleeping cars.

Chicago, Kansas & Nebraska.—This road has been leased by the St. Joseph & Iowa, the latter line running from St. Joseph to Trenton and being a part of the Chicago, Rock Island & Pacific.

Chicago, Rock Island & Pacific.—Republic, Kan., has voted against issuing bonds for aiding this road.

Chicago, St. Louis & Paducah.—The Mayor of Paducah, Ky., has subscribed $100,000 to this railroad, as ordered by the city council at its last meeting.

Cincinnati, Hamilton & Dayton.—This company's common stock of the Dayton & Michigan road, of which it held a controlling interest, has been sold to David Sinton and Thomas J. Emery. The price named is $1,000,000. The road extends from Dayton to Toledo, O., 141 miles. It is leased in perpetuity to the Cincinnati, Hamilton & Dayton.

There is likely to be litigation with reference to the supposed guarantee by this company of 3½ per cent. on 20,000 shares of the common stock of the Dayton & Michigan. The Dayton & Michigan is under perpetual lease to the Cincinnati, Hamilton & Dayton. By the terms of the lease the Cincinnati, Hamilton & Dayton guaranteed 3½ per cent. dividends upon all common stock of the Dayton & Michigan held by outsiders, but the guarantee did not extend to the large block of this stock held by the leasing company. The question now is whether this block of stock, which has been held by the leasing company for 17 years, becomes a guaranteed stock by virtue of its now being sold to outsiders.

The survey for the proposed extension from Richmond, Ind., to Jonesborough, in Grant County, to intersect the Cincinnati, Wabash & Michigan, was begun on June 11 by Col. E. A. Peck, Chief Engineer of the latter road.

Clay Centre, Minneapolis, Kanapolis & Western.—Incorporated in Kansas. The proposed road will extend through Clay, Ottawa, Lincoln, Ellsworth and Barton counties. The estimated length is 150 miles. Capital stock, $2,000,000.

Cortez & Dolores.—Incorporated in Colorado. The proposed road will be from Rico into the Montezuma Valley, and eventually to a connection with the Atchison, Topeka & Santa Fe.

Current River.—Contracts for grading 41 miles more of this road were let this week, making 81 miles now under contract. The road begins at Willow Spring, Mo., and extends to the Mississippi River, opposite Cairo, Ill. The new contractors are J. S. McLighe & Co., 20 miles; James Reilly, 11 miles; Kerns, Fudge & Co., 10 miles.

Dallas, Archer & Pacific.—Charter filed in Texas. The proposed line will extend from Dallas to Archer County, 120 miles, passing through the counties of Tarrant, Denton, Wise, Jack and Clay. Capital stock, $1,000,000.

Denver, Memphis & Atlantic.—The road was completed 14 miles east of Winfield, Kan., June 6. It is an extension of the Missouri Pacific and is now open for business from Chetopa to Stafford, 300 miles.

The entire force of tracklayers is now engaged on the 35 miles of road between Stafford and Larned, which will be completed by July 1, when the Winfield, Genda Springs & Southern, an extension from Winfield to Sweetwater, Tex., will be put under construction from Winfield to the state line at Caldwell, 40 miles southwest. Municipal bonds have been voted to aid in the building of this part of the line.

Denison, Bonham & New Orleans.—Work was commenced at Denison, Tex., on this road on June 9. It is intended to push the road at once to Pittsburgh, Tex., 125 miles.

East Portland & Vancouver Railway & Ferry.—Incorporated in Oregon to construct and operate a line of road from East Portland to Vancouver, together with ferry boats on the Columbia and Willamette rivers.

Fitchburg.—The company has applied to the Massachusetts Railroad Commissioners to increase its capital stock $3,000,000.

Freemont, Elkhorn & Missouri Valley.—Four hundred men went to work last week grading the extension of this road from Rapid City to Whitewood, Dak. Trains are expected to be running to Whitewood by Oct. 1.

Garden City, Dighton & Southern.—Incorporated in Kansas. The company proposes to build a road from some point on the Denver, Memphis & Atlantic, in Lane County, to Garden City, and from Garden City southwestward, through the counties of Finney, Haskell, Grant, Stevens and Morton, to the state line. Capital stock, $2,000,000.

Gulf, Colorado & Santa Fe.—The grading on the extension of this road between Cleburne and Weatherford, Tex., was begun last week. This part of the road is expected to be in operation by November.

Hidalgo, Mexico.—The report of the Hidalgo Railroad, according to the Mexican *Financier*, sets forth on the strength of a comparison of its rates with the rates by diligence and carts, that the saving on the business done by the road during the six years it has been in operation amounts to $1,383,5d0, or almost double the amount of the subventions, $748,685, granted by the Federal Government and the state of Hidalgo, and the conclusion is reached that the 6,000 kilometres of railroad in Mexico contribute more than $43,000,000 annually to decrease the cost of distribution in that country, besides the saving of time and danger.

It is urged that this showing justifies the efficacious protection of the railroads and their extension, and further that "the disproportion between the benefits obtained by the public and the profits secured by the companies, together with the temporary difficulty of paying the subventions, seem to indicate the modification of the concessions in the sense of increasing prudently their tariff rates, reducing at the same time the rate of the subventions and assuring their payment.',

Hope & Shreveport.—Articles of incorporation filed in Arkansas. The company proposes to build a road from Hope in Hempstead County, to a point on the Louisiana line in Fayette County, between ranges 24 and 25 west, a distance of 50 miles. Principal office, Hope. Capital stock, $500,000.

Illinois Central.—It is reported that this company is behind the new Missouri Central, and by that road will go to Kansas City, Mo. The new line will run up the Mississippi River on the Illinois side from East St. Louis to Alton. It will cross the river there and run west about midway between the Chicago and Alton and the Missouri Pacific, crossing the Missouri River near Booneville and entering Kansas City by way of Independence, Mo.

Indianapolis, Decatur & Springfield.—There is trouble between this road and the Cincinnati, Indianapolis, St. Louis & Chicago over the building of an independent track by the former company into the Union Passenger Station in Indianapolis, Ind. The Decatur people have been paying for the privilege of running over some 600 ft. of the Cincinnati, Indianapolis, St. Louis & Chicago tracks. They wished to stop doing this, and the other day went to work laying a track of their own, which had to cross the tracks of the other road. This led to a dispute and rough tactics were resorted to, the Cincinnati people demolishing the crossing as soon as

it was built. The others assert that they have established their legal rights and are prepared to finish the work.

Intercolonial.—It is stated that the government o Canada is likely to favorably consider the proposition of the German syndicate to develop the iron industry of the Dominion, as reported in the *Railroad Gazette* last week. The capitalists make the following proposals: First, to build certain extensions of the Intercolonial in Cape Breton. In this they would occupy largely the position of ordinary contractors. Second, to establish blast furnaces in Nova Scotia for the manufacture of steel rails. They offer to put up works costing $1,500,000, with an annual capacity of at least 40,000 tons of rails, provided the government will contract to take 200,000 tons of rails within six years, will admit plant, etc., free of duty, and will put a duty of $17 per ton on rails for 10 years. Third, they offer to operate the Intercolonial Railway with its extensions. The syndicate, it appears, does not propose to purchase the Intercolonial by the payment of any cash down. They would operate the road and its extensions, and the profits would be divided in a fixed percentage between the company and the Government. The company would also expect subsidies to aid in the extension of the present road.

Kansas City, Wyandotte & Northwestern.—The company has made an 18 year contract with the Inter-state Railway Co. to deliver its trains in Kansas City over the elevated road and through the tunnel now being constructed. The cars will be running soon from Leavenworth, Kan., over the elevated road to the Union Depot in Kansas City.

Kaskaskia, St. Elmo & Southern.—The St. Elmo, Carbondale, Metropolis & Paducah has been transferred to this company, which is building its line from Altamont, Ill., to Sheffield, Ala., through Williamson, Johnson and Massac counties, thence through Kentucky and Tennessee to Sheffield.

Leavenworth Northern & Southern.—The road is completed from Weldon, Kan., through Leavenworth to Atchison. The contract for the Leavenworth depot will be let this month. The structure will cost $50,000.

Leroy & Carey Valley Air Line.—Company filed charter in Kansas. The purpose is to construct a line from Leroy to Carey Valley on the south line of the state in Chautauqua County. Estimated length by road, 80 miles. Capital stock, $1,000,000.

Lookout Mountain.—It is stated that 1,500 men are at work grading the standard gauge road up Lookout Mountain, Chattanooga, Tenn.

Louisville & Nashville.—The case of George Rice, a coal oil refiner, of Marietta, O., against this road and the Standard Oil Company, charging freight discrimination on the part of the railroad, and a conspired endeavor by both defendants to shut him out of the South and curtail his business, has been decided in Kentucky in favor of the defendants.

It is stated that the principal southern shops of the company are to be located near Birmingham, Ala. The shops at Mobile, Montgomery, Nashville and other places will be concentrated there. One hundred acres of land have been selected near the city.

Manhattan.—The Rapid Transit Commission met this week to arrange the routes for the new elevated roads in New York. In regard to fare, the Commission decided that the charge is to be five cents, except between the hours of 1 and 2 a. m., when the company may charge six cents. The Commission decided that a continuous journey should be understood to mean a journey from any point on the roads established by them to any point on the Manhattan or on the roads operated by it.

The capital stock of the new company is to be $500,000, being 5,000 shares at $100 each. Of this sum ten per cent. is to be paid in cash. The bridge platforms may be used by any other corporations of existing elevated railroads, provided such corporations pay their reasonable proportion of cost of constructing and maintaining the improvements. The corporation is to pay five per cent. on one-twelfth of the gross receipts. This point can be better understood in the light of the statement that the Manhattan is expected to operate the extensions. Their extensions will constitute about one-twelfth of the total mileage of the entire lines of the company, and the purpose is to tax the company five per cent. upon the 3.30 miles embraced in the new purchase, or about one-twelfth of the entire line. The commission believes that the completion of the loop in Battery Park as proposed by them will eventually result in the removal of some of the obstructions already there, and the building of a better designed structure.

Marietta & Lake Erie.—Articles of incorporation filed in Ohio. The road will extend through Washington, Athens, Morgan, Perry, Fairfield, Muskingum, Licking and Franklin counties, and, it is said, will be the southern section of a line to be built between Marietta and Toledo, O., through Columbus.

Mexican National.—The Mexican National (narrow gauge) Railroad publishes a circular in which it is said that after the completion of the reorganization proceedings it will be ready to contract for the grading, bridging, masonry and trestle work on about 364 miles of road, between Saltillo and San Miguel Allende. Those wishing to bid should address D. C. Dodge, Vice President, City of Mexico, or W. G. Raoul, President, 32 Nassau street, N. Y. City.

Minnesota & Southwestern.—Articles of incorporation filed in Minnesota. The road is to be built from Northern Pacific Junction southeast to the boundary line between Minnesota and Wisconsin. Office at Northern Pacific Junction. Capital stock, $5,000,000.

Mississippi, Faribault & Northwestern Air Line.—The Board of Trade of Faribault, Minn., have voted to organize a company by this name to build a road from Wilmar, Minn., to a point on the Mississippi River.

Mobile & Dauphin Island.—Work was begun on this road on June 15. It will be built from Mobile, Ala., down the west shore of Mobile Bay, and cross Grant's Pass to Dauphin Island. Bulkheads 2,100 ft. long and 750 ft. wide will be constructed. From there bulkheads will extend into deep water in the bay. Four piers, each 450 ft. long, will be supplied with appliances for loading coal, iron, cotton and naval stores. The principal engineering difficulty is the bridging of Grant's Pass. The remainder of the road can be easily and quickly constructed. George Leighton, lately in charge of the big bridge over the Harlem River, New York, is the chief engineer. Robert Staats has the contract for the docks, bulkheads and trestling. It is intended to have the road finished by Jan. 1 next.

Nevada Central.—The road will be foreclosed on June 21 under the first mortgage, and the stock, which is nearly all owned by the Union Pacific, will be wiped out. The first mortgage bondholders are assessed $15 a bond for expenses, and they are to receive dollar for dollar new first mortgage 4 per cent. 50-year bonds and an equal amount of stock. Income mortgage bondholders will get the same amount of new stock.

Newport & New York Rapid Transit.—A charter has been granted this company in Rhode Island. It is intended to cut a canal across Conanicut Island, making a landing on the mainland, thence to connect by a new branch road with the New York, Providence & Boston.

Newton, Attica & El Paso.—Incorporated in Kansas to build a road from Newton, Harvey County, Kan., to the south state line, by way of Attica, Sedgwick, Kingman, Harper and Barber. Estimated length, 100 miles. Office, Attica.

New Jersey Junction.—The road built by the New York Central & Hudson River from Weehawken to Jersey City, N. J., is completed. It will hereafter be used as the connecting link between the Pennsylvania and West Shore roads. The first train to pass over it had on board President Cleveland and his party.

New Road.—It is reported that the Mexican government has granted a franchise and a sufficient subsidy for building a railroad from Esenada in lower California, to Yuma, Ariz.

Milton Shirk, of Paris, Ind., is negotiating with eastern men for the building of a railroad along the tow path of the old Wabash & Erie Canal from Wabash to Lafayette, Ind., of which he is owner. The road would parallel the Wabash Railway.

New York, Chicago & St. Louis.—F. P. Olcott, representing the Purchasing Committee of this road, has bought the old Wabash & Erie Canal property from the Ohio state line to Lagro, Ind. The price was $15,000.

New York, Lake Erie & Western.—An order has gone into effect making Binghamton, N. Y., the headquarters and starting place for the passenger trains that have hitherto stopped at Elmira. It necessitates the removal of some fifty families.

New York, Susquehanna & Western.—A double track is about to be laid from Jersey City to Paterson, N. J.

New York & New England.—W. H. Starbuck, representing this company, has amended his offer of $250,000 for the city of New Haven's interest in the New Haven & Derby road by agreeing to extend the road to connect with the New York & New England within one year, and to liquidate the first-mortgage bonds held by the city, and to change the second-mortgage bonds to first-mortgage bonds. He further agrees to maintain a competing line of steamboats to be run in connection with the road from New Haven to New York.

New York, New Haven & Hartford.—At a meeting of the directors it has been decided to call a meeting of stockholders at New Haven on July 14 to act on the proposed lease of the New Canaan Railroad at 4 per cent. on the capital stock and taxes; the Naugatuck, at $200,000 a year and taxes; the New Haven & Northampton, at 1 per cent. on the stock for the first year, 2 per cent. for the next three years, 3 per cent. for the next three years, and 4 per cent. for the rest of the lease; and the Hartford & Connecticut Valley at 4 per cent. on the stock for 99 years. The directors have already authorized these leases.

The Railroad Commissioners of Connecticut have given permission to the company to run all its Sunday trains throughout June.

Vice-President Reed is reported as saying that if his company does not obtain possession of the New Haven & Derby road a new line will be built to connect with the Naugatuck near Derby and with the New York, New Haven & Hartford near West Haven.

Old Colony.—Work has commenced on the new line from Matfield to Easton, Mass., 6½ miles, and will be completed in the fall. The company has recently finished double-tracking the road from New Bedford to Acushnet, a distance of 2½ miles.

Oregon & California.—The company has applied for permission to enter into a contract with the Pacific Improvement Co., of California, for the construction and equipment of the uncompleted portion of the line, and to replace the present iron rails with steel. The application is made necessary by the injunction placed upon the company when it was in the hands of a receiver.

Oregon Pacific.—A syndicate composed of Rowland G. Hazard, Samuel S. Sands, A. S. Barnes, T. Egenton Hogg, S. V. White, George S. Brown, F. W. Rhinelander and others have subscribed for the unissued 6 per cent. first-mortgage gold bonds of this company. The syndicate's purpose is to complete the road from its starting point at Yaquina Harbor, Oregon, to its eastern terminus at Boise City, Idaho.

Pacific.—A report has been sent from the Commissioner of the General Land Office at Washington to the Pacific Railroad Commissioners, setting forth the amounts of land granted and patented to the several companies whose affairs are now under investigation. The summary shows that the total amount granted to the Union Pacific was 11,309,344 acres, of which amount 3,147,682 acres have been selected and 2,616,178 acres patented, leaving 8,162,162 acres to be selected. The Central Pacific had a grant of 8,000,000 acres. It has received patents for 1,040,210 and has 6,413,712 acres yet to be selected. The Kansas Pacific had a grant of 6,000,000 acres. It has selected 1,788,252 acres, of which amount 963,714 acres have been patented. It has 4,211,748 acres yet remaining to be selected. The selections made by the remaining companies have nearly all been patented, and cover about all the available lands in their grants. The selections are as follows: Central Branch, Union Pacific, 222,560 acres; Western Pacific, 453,794 acres; Sioux City & Pacific, 43,336 acres.

Pennsylvania.—It is stated that the franchises of the Bergen Point and Port Richmond Ferry Co have been transferred to this company. This ferry runs from Bergen Point, N. J., to Port Richmond, Staten Island. It has been denied that the Pennsylvania intends creating an extensive shipping and receiving station on Staten Island, and the venture is said to be purely local in its bearings, and entirely distinct from the general traffic of the road.

The company has entered into an arrangement with the Easton & McMahon Transportation Co. for the shipment from the Greenwich piers in Philadelphia to the Eastern ports of all the bituminous coal coming over the road.

Pennsylvania & New England Construction Co.—Under this title a company has been incorporated in New Jersey for the purpose of establishing a complete line from Slatington, Pa., to Hartford, Conn., and Springfield, Mass., by the purchase and consolidation of such roads as are necessary. This is the syndicate which some time ago secured control of the Hartford & Connecticut Western. It is proposed to build a new line from Poughkeepsie to some point on the Hartford & Connecticut Western. A charter has been obtained for a branch from Tariffville, Conn., to Springfield. The syndicate has bought the Pennsylvania, Slatington & New England.

Philadelphia & Reading.—The receivers' certificates were redeemed this week. Drexel & Co. have been refunded money advanced on coupons of the consolidated mortgage, and the two overdue coupons of that mortgage are to be paid within the next thirty days. Another assessment of $3,000,000 on the junior securities will be paid July 1, and this will be applied in the course of time to the further payment of receivers' obligations.

Pittsburgh & Lake Erie.—The application of the Vanderbilt heirs to break the trust deed covering the majority of this company's stock was argued in Pittsburgh this week. Attorney for the Vanderbilts argued that the trust was against public policy, and at best was but a proxy and was revocable. The case will decide the question of the right to create railroad trusts and will dispose of a $10,000,000 property. Decision is reserved.

Richmond & West Point Terminal.—This company has absorbed the Mobile & Birmingham from Mobile to Marion Junction, Alabama.

Rich Hill, Arkansas City & El Paso.—Incorporated in Kansas, Missouri and Texas. The road is to extend from Rich Hill, Mo., through Linn, Bourbon, Allen, Neosho, Woodson, Wilson, Greenwood, Elk, Chattauqua and Cowley counties to El Paso, Tex., 180 miles. Capital stock, $1,000,000.

St. Louis, Oak Hill & Carondelet.—This road is completed from St. Louis to Carondelet, Mo., 11 miles, and will be open for traffic in a few days.

St. Louis & San Francisco.—The case of E. L. Oppenheim & Co. against this company, to set aside the annual election, will be heard on June 22 in St. Louis.

Springfield, Shelbyville & Mount Carmel.—The President of this company is arranging for an entrance of the projected road into Springfield, Ill., with terminal facilities. He wishes to enter the depot occupied by the Illinois Central and the Ohio & Mississippi. The survey is now in progress between Effingham and Springfield. The line will extend from the latter place to Shelbyville.

Suffolk & Carolina.—The road has been extended from Bosley to Hobbs' X Roads, Va., 6½ miles.

Texarkana Northern.—President Hinckley has offered to the city of Texarkana, Ark., to complete this road from the south bank of the Red River to Fort Smith. Red River is to be bridged and the road completed by Jan. 1, 1888. Texarkana is to raise $120,000, of which $85,000 is already subscribed. The Atchison, Topeka & Santa Fe is behind the scheme.

Texas & Pacific.—Thomas E. Stillman, of New York, representing holders of income land grant bonds of this company amounting to about $8,000,000; Judge Baker, of Texas, representing the railroad company; Judge Howe, of this city, representing the receivers; Winston S. Pierce, Jr., of New York, representing the trustees of the income land grant mortgage on said road, and Mr. Dale, of Philadelphia, on behalf of the Fidelity Trust Co., appeared in the United States Circuit Court, at New Orleans, this week, on an application of a foreign order for the conveyance to the bondholders of certain Texas state grant lands belonging to the Texas & Pacific road in Texas. The indebtedness on the land grant mortgages is about $8,000,000 on the first mortgage, but about $3,500,000 on the consolidated mortgage. Considerably over $9,000,000 income mortgages, $8,000,000 of the principal and nearly $2,500,000 of outstanding scrip were issued in lieu of interest. The indebtedness on the terminal mortgages amounts to about $5,000,000; on the New Orleans & Pacific Division to over $6,000,000, and on the Rio Grande Division to $13,000,000. There are unsold land grants aggregating about 3,000,000 acres involved in this case. It is proposed to sell the road under the various mortgages submitted

There will be a line built from Prudhomme Station, on this road, to Natchitoches, La., which city has voted a tax and appropriated lands for the enterprise. The road will be 16 miles long.

A case brought by this company against B. H. Epperson was decided last week in Texas. It was to set aside the sale of 75 sections of land in Willbarger and Clay counties, which formerly belonged to the Memphis, El Paso & Pacific company and had been sold by a sheriff in order to satisfy a claim of Epperson's for $60,000. Afterward these lands were transferred by the Memphis, El Paso & Pacific to the Texas & Pacific, and the latter brought the suit for the setting aside of the sale with the successful result as stated.

Toledo, Cincinnati & St. Louis.—Judge Matthews, in Cincinnati, O., has reversed a decision made by Judge Baxter in 1883, setting aside a decree in favor of the Grant Locomotive Works against this road, and has reinstated that decree on the ground that Judge Baxter had no right to make the ruling he did after the close of the term. The amount involved is over $100,000.

Union Pacific.—A dispatch from Omaha, Neb., says that it has been discovered that conductors and brakemen on the Union Pacific have been carrying out a systematic scheme of robbery like that exposed some months ago on the Pennsylvania Railroad.

Wabash Western.—The through passenger service over this road from Niagara Falls to Chicago, which has heretofore gone over the Baltimore & Ohio from Auburn Junction, Ind., to Chicago, will, after June 20, be withdrawn from that road and be run via Laketon Junction and the Chicago & Atlantic, thus reaching Chicago over the Chicago & Western Indiana, instead of the Illinois Central tracks.

Wheeling & Lake Erie.—It is reported that the company intends building a line from Creston to Cleveland, O., 46 miles.

West Jersey.—The company contemplates improvements on its road which will cost $300,000, divided as follows: Advances for extension into Bridgeton, $130,000; additional freight equipment, $70,000; advances to the Maurice River Railroad, $100,000.

TRAFFIC AND EARNINGS.

Cotton.

The cotton movement for the week ending June 11 is reported as below, in bales:

Interior markets:	1887.	1886.	Inc. or Dec.	P. c.
Receipts	6,150	11,026	D. 4,886	44.2
Shipments	8,324	31,970	D. 23,646	73.9
Stock	51,659	118,907	D. 67,248	56.5
Seaports:				
Receipts	4,032	22,773	D. 18,741	82.2
Exports	5,588	81,287	D. 75,699	93.1
Stock	327,774	443,977	D. 116,203	26.1

Total movement from plantations for the crop year ending June 10 was 6,311,310 bales, against 6,408,057 last year, 5,588,824 in 1884–85, and 5,615,954 in 1883–84.

Central Traffic Association.

A meeting of the passenger department of the Central Traffic Association began in Chicago on June 12. Nearly every important line was represented. The first matter to come up for consideration was a resolution to adopt the trunk line rule of two cents per mile for parties of 40 or more traveling

together in one direction. The meeting declined to take such a step. A rate of one lowest unlimited fare for the round trip was made for the National Educational Association to meet in Chicago in July. For large political conventions, and meetings of similar character that cannot be handled on the certificate plan, excursion rates on round trip tickets were allowed to be authorized by the vice-chairman, when assented to by three-fourths of the lines terminating at the point where the meeting is to be held. One fare round trip tickets for the grand encampment of the Grand Army of the Republic at St. Louis were ordered placed on sale Sept. 20, the sale to close Sept. 25, good for return up to and including Oct. 2.

Coal.

Coal tonnages for the week ending June 11 are reported as follows:

	1887.	1886.	Inc. or Dec.	P.c.
Anthracite	638,198	672,688	D. 34,490	5.1
Bituminous	273,368	229,878	I. 43,490	18.9
Coke (June 4)	14,999	77,107	D. 62,108	80.5

The coal tonnage of the Pennsylvania road for the week ending June 4 is reported as below:

	Coal.	Coke.	Total.	1886.
Line of road	190,534	14,599	205,533	210,865
Year to date	4,409,710	1,552,994	5,962,704	4,699,096

Decrease for the week 5,332 tons, or 2.5 per cent.; increase for the year 1,263,608 tons, or 26.8 per cent.

Cumberland coal shipments for the week ending June 11 were 70,667 tons, and for the year to that date, 1,375,967 tons, an increase of 779,419 tons, as compared with last year.

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

Month of May:

	1887.	1886.	Inc. or Dec.	P. c.
Atch., T. & S. Fe.	$1,547,805	$1,198,173	I. $349,632	29 1
Atlantic & Pac.	262 631	119,133	I. 143,498	120 4
Buff., N. Y. & P.	207,100	213,323	D. 6,223	2 9
Buff., R. & Pitts.	192,353	77,681	I. 114,672	147 5
*Bur., C. R & No.	151,228	138,894	I. 12 334	8.8
Cairo, V. & C.	60,880	55,530	I. 5,350	9.6
California South.	116,875	58,123	I. 58,752	101.1
Canadian Pac.	923,000	807, 96	I. 115,704	14.2
Cape F. & Y. Vy.	18.438	15.229	I. 3,209	21.1
Ches. & Ohio	358,491	307,293	I. 51,198	16.6
Eliz., L. & B. S.	80,124	63,128	I. 16,996	26.9
Ches., O. & S. W.	134.411	113,692	I 20,719	18.2
Chic. & Atlantic	145.129	111,467	I. 33,662	30.1
Chi. & East. Ill.	155.436	115.133	I. 40,308	35.1
Chi., Mil. & St. P.	1,866,000	1,767,069	I. 98,931	5.5
C., St. L. & P.	410,356	358,666	I. 51,660	14 4
Chic. & W. Mich.	116,493	107,168	I. 9,325	8.6
Cin., H. & Day.	269.348	215,505	I. 53,843	25.0
C., I., St. L. & C.	214,024	191,698	I. 22,326	11.6
Cin., N. O. & T. P.	261,754	195,232	I. 66,522	34.0
Ala. Gt. South.	114,789	78,275	I. 36 514	46.6
N. Ori. & N. E.	47,222	44,008	I. 3,214	7.3
Vicks. & Mer.	37,056	36,286	I. 770	2.1
V., Shre. & P.	31,530	20,272	I. 11,258	55.4
Cin., R. & Fr. W.	31,107	27,780	I. 3,327	11.9
Cin., W. & Balt.	155,830	144,715	I. 11,115	7 6
Cleve., Ak. & C.	45,511	44,314	I. 1,197	2.7
Cleve. & Canton.	31,990	29,254	I. 2,036	6.9
Cl., C., C. & I.	305,897	295,771	I. 10,126	3 4
Col. & Cin. Mid.	20,970	23,131	D. 2,161	9.3
Col., H.Vy. & Tol.	183,509	167,788	I. 24,721	12.3
Den. & R. G.	619,077	510,068	I. 109,009	21.3
Det., B. C & Al.	46,276	23,206	I 23,070	9.9
Det., Lan. & No.	97,580	92,805	I. 4,755	5.1
*E. Ten., Va. & G.	248,412	203.210	I. 45,202	22.2
Ev. & Ind'apolis.	17,533	11,148	I. 6,385	57.5
Ev. & Terre H.	73,863	57,391	I. 16,472	28.7
Flint & Pere Ma.	226,149	190,670	I. 35,479	18.6
Fla. Ry. & N.	84,354	76,156	I. 8,198	10.7
Ft. W. & Den. C.	56.356	31,869	I. 24,487	76.7
Georgia Pacific	85,999	47 882	I. 38,117	79.5
Grand Rap. & I.	183,700	152,596	I. 31,104	20.3
Grand Tr. of Can.	1,327,138	1,228,681	I. 98,457	8.0
Houston & T. C.	147,412	144,892	I. 2,520	1.7
Illinois Central:				
South. Div.	862,484	774,146	I. 88,338	11.4
Iowa Div.	136,681	134,191	I. 2,470	18.4
Ind., Bloom. & W.	193,572	180,686	I. 12,886	7.0
Ind., Dec. & Spr.	29,371	26,706	I. 2,665	9.9
*K. C., Ft. S. & G.	139 5 9	119,034	I. 20,475	17 2
*K. C., Spr. & M.	114,268	77,561	I. 36,707	47.3
*K. C., Clint. & S.	9,823	11,061	D. 1,238	11.1
*Kingston & Pem.	10,509	7,932	I. 2,577	32.6
Lake Erie & W.	142,346	118,834	I. 23,512	19.7
Lehigh & H. R.	16,717	16.647	I. 70	.4
Long Island	254,707	229,698	I. 25,009	11.1
Lou., Ev. & St. L.	79,948	62,659	I. 17,289	27.5
Louisv. & Nashv.	1,228,915	1,038,894	I. 190,021	18 2
Lou., N. A. & C.	177.570	131,895	I. 45,675	34 6
Lou., N. O. & T.	114,917	103,651	I. 11,266	10.8
Manhattan Elev.	717,625	659.491	I. 58 134	8.8
Marq., H. & O.	113.111	130,651	D. 17,540	13.4
*Mem. & Charles.	84 913	62,397	I. 22,516	36.0
†Mexican Central.	394,900	318,403	I. 76,497	24 0
†Mexican National:				
South. Div.	99.301	94,716	I. 4,585	4.8
Mil., L. S. & W.	298,068	199,032	I. 97,036	48.7
Mil. & North.	75,174	46,955	I. 28,219	60.0
Minn. & N. W.	82,049	36,596	I. 45,453	124.1
Miss. & Tenn.	22,862	23.520	D. 658	2 8
Mobile & Ohio	177,110	159,095	I. 18,018	11.3
N. Y. C. & H. R.	2,887,020	2,512,622	I. 344,398	13.5
N. Y. City & No.	48,194	46,092	I. 2,102	4 5
N. Y., Ont. & W.	128,377	105,716	I. 22,661	21.4
Norfolk & West.	294,617	208.425	I. 86,192	41.3
Northern Pac.	1,019 900	983,731	I. 36,169	3.6
Ohio & Miss.	303.163	298,035	I. 5,128	1.7
Ohio Southern.	36,840	31,158	I. 5,682	18.2
Oreg. R. & N. Co.	420,000	480.345	I. 60,345	12.5
Peoria, Dec. & E.	74,438	56,523	I. 17,915	31.7
Pitts. & West.	146,712	127,434	I. 19,278	
Rich. & Danville.	321,200	281,114	I. 40,086	15.1
Va. Mid. Div.	126,000	117.023	I. 8,977	7.6
Chas., C. & A.	47,000	47.877	D. 877	1.8
Col. & Gr. Div.	32,000	29,316	I. 2,684	9 1
West. N. C. Div.	39 900	32,713	I. 7,187	21.9
Wa., O. & W.	9,200	8,200	I. 1,000	12.1
St. Jo. & Gr. I'd.	76,969	89,681	I. 12,712	14.1
St. L., A. & T. H.	100,156	104.431	D. 4,275	4.0
Branches	43,358	33,579	I. 9,779	29.1
St. L., A. & Tex.	162,022	108 378	I. 53.644	49.4
St. L. & San F.	443,776	354.809	I. 88,967	25.3
St. P. & Duluth.	135,036	116,650	I. 18,386	15.7
St. P., M. & Man.	580,510	435,462	I 147,048	33.9
Shenandoah Val.	68,000	54,763	I. 13,237	24.1
Staten I'd R. T.	75,084	68,009	I. 7.075	10.4
Texas & Pacific.	309,307	449,908	D. 140,601	31.2
Tol., A. A. & N. M.	34,049	24 858	I. 9,191	36 9
Tol. & Ohio Cen.	73,864	73,401	I. 463	.6
Wabash (West)	484,204	418 167	I. 66,037	15.7
Wheeling & L. E.	56,268	41,091	I. 15,177	36 9
Wisconsin Cen.	159,498	120,465	I. 39,033	32 3
Min., S. C. & W.	34,304	17,327	I. 16,977	98.1
Wis & Minn.	70,520	13,746	I. 56,774	4.4
Total	$26,132,332	$22,594,531	I. $3,537,801	11.2

* Three weeks of May in each year. † Mexican currency.

Early reports of monthly earnings are usually estimated in part, and are subject to correction by later statements.

The Chesapeake & Ohio Canal.

The shipments by the Chesapeake & Ohio Canal this year are nearly 60,000 tons in excess of the same period of 1886. A notable feature of this year's trade, however, is the small number of companies trading by this thoroughfare. The only heavy shippers are the Consolidation and the George's Creek companies, who have a considerable trade at Alexandria, Washington, Williamsport and various points along the line of the canal. The Maryland Coal Co. made heavy shipments in March, but since the first of April has not sent out a single boat. The Borden Coal Co. also made but light shipments in April and May. The number of way bills issued to date is 585. The first way bill was issued in March. The first way bill last year was issued June 1. The delay was caused by the strike in the coal regions and by the damage done to the canal by the spring freshet. The trade of this month has about equaled the trade of last June.

The Inter-state Commission.

The Boards of Trade of Farmington, Northfield, Faribault, Owatonna, Minn., have filed a complaint with the Commission, charging the Chicago, Milwaukee & St Paul with unjust discrimination of rates on wheat, flour and mill stuffs from those cities to points on the road in Iowa, Wisconsin and Illinois. The specific complaint preferred is that shippers at these points are charged 18 cents per 100 pounds on wheat, flour and mill stuffs, while the rate charged shippers for a like service from St. Paul, Minneapolis and other points in the state is but 7½ cents per hundred pounds.

Mr. Wm. Brown, who represents the Chicago & Alton and Chicago, Rock Island & Pacific Railroads in the cases of complaint against the Pennsylvania Railroad Co. for refusal to exchange passenger traffic with the complaining roads, appeared before the Inter-state commission, on June 14, and asked if there was any method of compelling the Pennsylvania Co. to produce certain papers in its possession deemed necessary in the hearing. He was told that the Pennsylvania Co. would be requested to produce any papers or documents deemed of importance, and if the corporation should refuse to do so upon request, then a compulsory process would be issued.

The answer of the Providence & Worcester Railroad Co. to the complaint of the Providence Coal Co. has been sent to Commission. It is a specific denial of the charge of unjust discrimination in favor of coal shipped at East Providence to any point on its road. The company also denies that it has given undue and unreasonable preference and advantage to any person.

Pacific Coast Business.

The shipment of through freight from San Francisco overland for May amounted to 17,000,000 pounds, this total being the smallest in several years. The Inter-state Commerce law went into effect April 4, and, though the operation of the long and short haul clause was suspended before the end of that month, the volume of trade was much less in April than in March, and the total for May is 4,000,000 pounds less than for April. Considerable freight, however, was diverted north to the Canadian line.

Rates on Exhibits.

Chairman Fink of the joint committee has issued the following notice regarding the shipment of exhibits to the Interstate Industrial Exposition, to be held at Chicago from Sept. 7 to Oct. 22, 1887: "On all exhibits forwarded to this Exposition full tariff rates shall be charged, but that such exhibits, if unsold and reshipped in thirty days after the close of the Exposition, will be returned free by the roads, members of the joint committee, which carried the same, upon presentation of a certificate signed by the proper officers of the Exposition to the effect that the shipments are unsold exhibits which have paid full tariff rates one way."

Special Rates for the Master Mechanics' Meeting.

Jno. N. Abbott, Chairman of the Western States Passenger Association, announces that a reduction to fare and one-third for the round trip upon the certificate plan has been granted by lines in that Association for persons attending the Master Car-Builders' and Master Mechanics' conventions, at Minneapolis, June 14–18, and St. Paul, June 20–25, respectively.

Pacific Coast Traffic.

The trunk lines and Central Traffic Association have issued a joint notice that the through rates and divisions on Pacific coast traffic, recently announced, apply only on west-bound shipments. The following through rates apply on east-bound traffic, governed by east-bound Pacific coast classification: From San Francisco and the usual California points, Portland and Astoria, Ore., and Tacoma and Seattle, W. T., to New York and other seaboard points: First class, $4; second, $3.20; third, $2.50; fourth, $2.15; fifth, $2; sixth, $1.75; seventh, $1.50; eighth, $1.25; ninth, $1. Divisions will be on the basis of 25 per cent. of the above rates east of Chicago.

Railroad Commissioners' Convention.

The Railroad Commissioners of the Northwestern states held a convention at St. Paul, Minn., last week. The meeting was held for the purpose of discussing the Inter-state law, and to secure as far as possible uniform legislation and action. The following were in attendance: Wisconsin, Commissioner Atley Peterson; Iowa, Commissioners Peter A. Dey and L. S. Coffin and Secretary E. C. Morgan; Nebraska, Commissioners O. P. Mason, J. H. Ager and Charles Buschow, and Clerk H. M. Waring; Dakota, Commissioners Alexander Griggs, Abe Boynton and N. T. Smith, and Secretary J. M. Quinn; Minnesota, Commissioners Austin Becker and Gibbs, and Secretary Warner. An organization was effected by making P. A. Dey, of Iowa, President, and E. G. Morgan, of Iowa, and H. M. Waring, of Nebraska, Secretaries. President Dey announced the following committees: On Classification of Freight in Different States, Commissioners Coffin, Iowa; Griggs, Dakota; Peterson, Wisconsin; Becker, Minnesota, and Mason, Iowa. On Programme, Commissioners Austin, Minnesota; Peterson, Wisconsin; Ager, Nebraska; Boynton, Dakota; Coffin, Iowa.

Boatmen Like the Law.

The convention of river and lake transportation men, called by the late Captain Stockdale, of Pittsburgh, assembled in Cincinnati, O., on June 13. The session was spent in conversation, in which the opinion was general that the Inter-state Commerce law was to be permanent, and that it portended prosperity for those engaged in water transportation.

East-bound Shipments.

The total shipments of all freight except live stock from Chicago through to seaboard points amounted last week to 29,721 tons, against 28,991 tons for the week previous. The percentage carried by each road was: Baltimore & Ohio, 13.7; Chicago & Grand Trunk, 11.9; Chicago, St. Louis & Pittsburgh, 8.9; Lake Shore & Michigan Southern, 18.6; Michigan Central, 16.4; New York, Chicago & St. Louis, 7.8; Pittsburgh, Ft. Wayne & Chicago, 19.5; Cincinnati, Indianapolis, St. Louis & Chicago, 3.2.

Southeastern Tariff Association.

This association held its annual meeting this week at Old Point Comfort, Va. The schedule of rates agreed upon does not differ materially from the former tariff. The officers are: Clarence Knowles, President; W. D. Deane, Vice-President; Chas. C. Fleming, Secretary, all of Atlanta. The Executive Committee consists of Thos. Egleston, L. Mims, W. P. Pattillo, W. T. Prioleau and John C. Whitney, of Atlanta, W. W. Carnes, of Macon; Robert E. Case, of Huntsville, Ala.; J. B. Eselle, of Columbia, S. C.; Clarence F. Law, of New Orleans, and S. Y. Tuper, Jr., of Charleston.

Cut in Freight Rates.

The Indianapolis & St. Louis has made an open cut of about 7 cents on live stock between St. Louis and Indianapolis. It is expected that other roads will meet it and that a rate war will ensue.

Milling in Transit.

A committee of the general freight agents of the Northwestern roads, to whom the general managers referred the milling in transit question, held a meeting in St. Paul, Minn., on June 13. A report was agreed upon, which will be submitted to the general managers not later than June 20.

ANNUAL REPORTS.

Chicago, Rock Island & Pacific.

The annual report of this company is published for the fiscal year ending March 31, 1887. The length of road operated is 1,384 2 miles, of which 1,121 miles are owned by the company. There are 162.7 miles of second track and 292.8 miles of side track.

The equipment has hardly changed since the last annual report, and is 336 locomotives, 24 sleeping coaches, 142 passenger coaches, 47 baggage, mail and express cars, 9 postal cars, 9 dining cars, 3 officers' and pay cars, 4,586 box, 1,237 stock, 1,788 platform, 259 caboose, etc., and 757 gravel and repair cars.

The general balance sheet is as follows:

LIABILITIES.

Capital stock	$41,959,800	
Fractional scrip outstanding, convertible into stock	200	
		$41,960,000
Six per cent. mortgage bonds		12,500,000
Five per cent. extension bonds		11,860,000
Chicago & Southwestern bonds, guaranteed		5,000,000
Addition and improvement account		8,213,000
Unused premium on five per cent. bonds sold		764,850
Accounts payable		789 036
Balance		856,226
		$81,743,112

ASSETS.

Cost of road and equipment	$60,120,853
Cost of bridge at Rock Island	758,526
Stock and bonds of connecting roads	8,260,058
Advances made to the Chicago, Kansas & Nebraska Co. as per contract of May 15, 1886	7,786 242
Loans and other investments	1,541,910
Six per cent. C., R. I. & P. mortgage bonds, on hand	400,000
Materials, fuel, etc., on hand	685,452
Accounts receivable	1,263,072
Cash and loans	926,999
	$81,743,112

The funded debt was increased $7,900,000, by the issue of the balance of $11,860,000 extension bonds, the proceeds of which have been used in building the Wisconsin, Minnesota & Pacific, the St. Joseph & Iowa, and the Chicago, Kansas & Nebraska roads. All the first-mortgage bonds $11,860,000 and a majority of the stock of these roads are owned and are deposited as a security for the 5 per cent. extension bonds of the Rock Island.

The earnings for the year were as follows:

	1886-7.	1885-6.	Inc. or Dec.	P. c.
Passengers	$3 097,916	$3,127,258	D. $29,342	0.9
Freight	8,037,453	7,713,659	I. 323,794	4.2
Mail	187,290	186,806	I. 484	0 2
Express	163.650	148,650	I. 14,980	10.0
Rents, interest, etc.	585,929	611,027	D. 25,098	4.1
Car mileage	238,621	208,821	I. 30,200	14.4
Telegraph	8,190	8,107	I. 83	1.0
Total	$12,319,049	$12,004,348	I. $314.701	2.6
Expenses	7,504,809	7,166,803	I. 334,931	4 9
Net earnings	$4,814,240	$4,837,455	D. $23,215	0.4
Gross earn. per m.	8,901	8 677	I. 224	2.6
Net " "	3,478	3,497	D. 19	0.4
Per cent of exps.	60.9	59.7		

Expenses include taxes, which were $394,856, against $391,871 last year.

Passenger earnings decreased $29,342, or .94 per cent., as compared with last year, being a decrease of $35,291 in earnings on business from connecting lines, and an increase of $5,949 from business originating on the road.

Freight earnings increased $323,798, or 4.2 per cent., as compared with the previous year. The revenue from through freight increased 9.79 per cent., and that from local freight decreased 2.47 per cent. Of the entire earnings, 57.28 per cent. was from through freight and 42.72 per cent. from local freight.

The traffic for the year was as follows:

	1886-7.	1885-6.	Inc. or Dec.	P.c.
Passengers carried	3.517,623	3.121,607	I. 396,016	12.69
Passenger miles	133,091,642	129 208,404	I. 3,883,238	3.00
Tons freight car	4,180.109	3.873,605	I. 306,504	7 88
Ton-miles	793,824,454	719,972,565	I. 73,851,889	10.26
Average rate:				
Per passenger-mile	2.328 cts.	2.420 cts.	D. .092	3.8
" ton-mile	1.010 "	1.070 "	D. .06	5.6

The average passenger journey was 38 miles, and the average freight haul was 190 miles.

Train miles.	1886-7.	1885-6.	Inc. or Dec.	P.c.
Passenger	2,712,961	2,485,655	I.	
Freight	7,677,913	7,158,707	I.	
Other	675,978	707,945	D.	
Total	11,066,852	10,352,307		
Average train load.				
Passengers, No.	49	52	D. 3.0	
Freight tons	107.8	106.4	I. 1.4	

The earnings per passenger-train mile were $1.14; per freight-train mile, $1.04; expenses per train mile all trains, including legal expenses and taxes, were 68c. The cost of maintenance of way per mile run was 12.86c. The car mileage was: passenger, 15,004,437; freight, 104,215,941; service, 3,687,077.

The land commissioner reports sales of 1,673.55 acres at $11.40 per acre, and the land remaining unsold to which the title is perfect is 15,617.3 acres.

The result of the year was as follows:

Surplus April 1, 1886		$544,523
Net earnings as above		4,814,240
Receipts from land department		230,000
		$5,588,763
Interest on bonded debt	$1,320 667	
Rental of leased lines	303,762	
Missouri River Bridge	170,922	
Dividend (7 per cent.)	2,937,186	4,732,537
Balance, surplus for the year		$856,226

Seventy-eight hundred tons of steel rails have been laid during the year, the greater part having been 70 pounds per yard, 10 pounds heavier than the previous standard, and 5,660 feet of cast-iron pipe from 16 to 48 in. diameter, has been put in culverts.